DOCUMENT RESUME

ED 196 734 SE 034 042

AUTHOR Adams, W. Sam
TITLE Assessment of Scientists'/Engineers' Continuing Education Needs in Small, Geographically-Dispersed Industries. Final Report.
INSTITUTION Wisconsin Univ., Oshkosh.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE Apr 80
GRANT NSF-SED78-21869
NOTE 163p.: Not available in hard copy due to marginal legibility of original document.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Adult Education: *Continuing Education; Engineering Education: *Engineers; Industrial Personnel; Needs Assessment; Professional Training; Science Education; *Scientific Personnel; Surveys

ABSTRACT

Reported is one of five studies of how scientists and engineers, located far from metropolitan areas, are able to maintain knowledge and skill levels in rapidly changing fields. This investigation concentrated on a representative sample of 30 small industries in central and northern Wisconsin. Interviews and questionnaires were used to assess interests and involvement in continuing education of both employers and research and development personnel. Results presented deal with types of continuing education opportunities, levels of participation, program effectiveness, company policies, and employees' needs and interests in continuing education. (Author/WB)

FINAL NSF REPORT

Assessment of Scientists'/Engineers' Continuing Education Needs in Small, Geographically-Dispersed Industries

by

W. Sam Adams, Ph.D.
Division of Continuing Education
University of Wisconsin-Oshkosh

National Science Foundation
(SED78-21869)

April 1980

TABLE OF CONTENTS

Study Highlites

Sampling & Demographics

1. Study (sample) firms are representative of industry in central and northern Wisconsin. (Table 6)

2. Major fields of engineers and applied scientists employment are mechanical engineering, design, industrial engineering and research and development. (Table 7)

3. Most middle managers have attended post-secondary school and 45% have a bachelor's or higher degree. (Table 11)

4. Less than half the middle managers have been working in technical jobs fewer than 10 years. (Table 13)

5. Over three-fourths of the middle managers read a journal regularly. (Table 14)

6. Over half of the middle managers consult with colleagues in other organizations on a regular basis. (Table 15)

Continuing Education Opportunities

7. UW 4-year campuses offer 170 degrees in applied science and engineering; 25% of these degrees are available in central and northern Wisconsin. (Table 16)

8. VTAE schools and institutes offer 344 diploma and associate degree programs in trade and industry; 58% of these programs are available in central and northern Wisconsin. (Table 19)

9. Wisconsin independent colleges and universities offer 102 applied science and engineering programs; only 36% are available in central and northern Wisconsin. (Table 21)

10. UW-Extension's applied science & engineering department offers an extensive independent study program and electromedia systems to deliver continuing education to "off campus" sites; technical regular courses, seminars, workshops, on the other hand, are available mostly in Milwaukee and Madison. (Table 22A)

11. Professional and trade associations offer both technical and non-technical programs; 45% of the technical and 16% of the non-technical programs were delivered in central and northern Wisconsin areas. (Table 23)

Continuing Education Participation

12. Programs provided by companies themselves are predominately technical. Very few non-technical courses are presented at the industrial plant. (Table 24)

13. Scientists and engineers participated in about two-thirds technical courses and one-third non-technical courses. In the future they would like a 25 per cent increase in technical subjects and an 11 per cent increase in non-technical subjects. (Table 25)

14. Scientists and engineers have participated most often in seminars, conferences and workshops as forms of continuing education delivery. While these were still desirable, respondents wanted a significant increase in the number of credit and non-credit college offerings in the future. (Table 26)

15. Most industrial employees participate in continuing education provided by non-educational institutions. However, in the future, respondents wanted post-secondary institutions, especially UW institutions, to provide a larger share of continuing education. (Table 27)

Continuing Education Accessibility

16. About two-thirds of top managers felt continuing education opportunities were accessible, but almost half also said they had problems with where these activities were located. (Tables 28 & 29)

17. The location of non-technical programs appears to be more of a problem than the technical programs. This supports an earlier finding that professional associations (#11) and companies (#12) do not offer many non-technical programs in the study area. (Table 30)

18. VTAE institutes were judged the most accessible types of organizations providing continuing education. Also technical courses taught in seminars, conferences, and workshop formats were more accessible than college technical credit courses. (Table 31)

Continuing Education Effectiveness

19. In-service technical courses were the most effective forms of delivery of instruction. (Tables 32, 33, 37)

20. College credit and non-credit courses were one of the least effective types of continuing education, but correspondence courses or organized self-study courses were the most ineffective forms of delivery. (Tables 32, 33, 37)

21. Technical courses tended to be more of a problem in meeting company continuing education needs than non-technical courses. (Table 36)

22. Technical inservice programs offered by the company itself were the most effective continuing education programs. (Table 37)

23. Scheduling of classes was a problem for a third of the respondents, and 20 per cent said more evening classes were needed. (Tables 38 & 39)

Continuing Education Attitudes

24. Over two-thirds of the top managers thought technical and non-technical continuing education was very important to their company. (Table 40)

25. The main reason continuing education was important was to keep employees current with technology, and to help employees perform their present jobs better. (Tables 41, 42, 43)

26. Company presidents rated the need for employee personal development much higher than did middle managers. (Tables 42 & 43)

Continuing Education Incentives

27. The primary motivators for employee participation in continuing education were self-satisfaction and personal growth. (Table 44)

28. The best continuing education delivery systems to motivate employees to perform their jobs better were seminars, conferences and workshops. (Table 45)

29. Top managers did not see employee motivation to pursue continuing education as a problem, nor did they feel the lack of incentives for employee participation in continuing education as a problem. (Tables 46 & 47)

Continuing Education Company Policies

30. Over two-thirds of the companies did not have a formal policy on continuing education. (Table 48)

31. Most companies reward employee participation in continuing education by recording these activities in their personnel file. Only 20 per cent provide pay raises, promotion, certificates of completion and released time. (Table 50)

32. A large number of companies did not have a differential policy for supporting employees pursuing a degree and those not seeking a degree. (Table 51)

33. Most companies had a policy that employees must successfully complete a credit or non-credit course in order to receive reimbursement. (Tables 52 & 54)

34. The numbers (%) of companies providing partial or full reimbursement for credit instruction were: 64% paid tuition, 40% paid books & supplies, 3% paid travel, and 20% gave released time. (Table 53)

35. The numbers (%) of companies providing partial or full reimbursement for non-credit instruction were: 68% paid tuition, 50% paid books and supplies, 13% paid travel and 16% gave released time. (Table 55)

36. Sampled companies strongly supported employees attendance of workshops, conferences and seminars. The numbers (%) of companies providing "total reimbursement" for these types of instruction were: 90% paid all fees; 87% paid for all books and supplies, and 80% paid for all travel expenses. (Table 56)

37. Organized self-study employees engaged in was the least supported type of continuing education activity. About half the companies partially and fully paid for employee fees and books and supplies. (Table 58)

Continuing Education Funding

38. Most companies fund their employees continuing education activities out of a departmental fund. (Table 59)

39. Companies average (median) annual expenditure for tuition and books, materials and travel costs increased from $900 to $1450 during 1976-1978. (Table 60)

40. Companies estimated they would spend on the average (median) $2165 in 1979 and $2,333 in 1981. (Table 61)

41. Top managers did not see monetary problems as a limitation to company personnel involvement in continuing education. Furthermore, these respondents thought there was a good return on their investment in continuing education. (Tables 62 & 63)

42. Only 17% of the middle managers enrolled in continuing education activities not supported by company funding. (Table 64)

Continuing Education Equipment and Materials

43. Very few companies owned their own education equipment. The equipment they did have were traditional items, e.g., movie and slide projectors. (Table 66)

44. The average expenditure to purchase, replace and maintain educational equipment was about $300 a year. (Table 67)

45. Only 25% of the companies owned educational materials (books, pamphlets, etc.). The average expenditure for these materials was $684 in 1978.

Chapter I

Introduction

The National Science Foundation has been concerned for some years with continuing education opportunities for scientists and engineers. Numerous studies have been commissioned and conducted over the years to keep abreast of this general concern. It was in 1977 that NSF decided to fund five projects which limited this concern to only small geographically dispersed industries. The problem simply stated was, how are scientists and engineers located at great distances from metropolitan areas able to keep up to date in technical fields which are rapidly changing.

The five selected NSF studies all dealt with this same problem. Battelle Columbus Laboratories sampled small firms nationally, North Carolina State University studied firms throughout North Carolina, three institutions (University of Missouri at Rolla, University of Arkansas and Oklahoma State University) investigated firms in the Ozark region, and the Charleston Higher Education Consortium visited firms in a tri-county area in South Carolina. The Wisconsin study, reported in this investigation, concentrated on small industries located in central and northern regions of the state. The upper three-fourths of Wisconsin became the study target areas because it is characterized by small towns to medium size cities with educational institutions not specializing in continuing education programs for scientists and engineers. On the other hand, the southern geographical quarter of the State has a high density population and a long history of well developed scientists and engineering continuing education programs offered through University of Wisconsin-Extension, University of

Wisconsin-Madison, University of Wisconsin-Milwaukee, and other post-secondary institutions and professional associations.

While some applied scientists and engineering programs have been delivered in the study area, no comprehensive needs assessment has been conducted since 1972 to determine how extensive such programming is needed.

Project Objectives

Using a representative sample of 30 small geographically dispersed industries in the central and northern three quarters of Wisconsin, the following objectives were assessed in this study:

1. To determine existing continuing education opportunities for employed scientists and engineers in the study area.
2. To identify the agencies, institutions, industries and professional associations which provide continuing education, credit and non-credit, courses in the study area.
3. To investigate the type of instructional systems currently being used by industry to deliver continuing education for employed scientists and engineers in the study area.
4. To determine the accessibility of continuing education opportunities for employed scientists and engineers in the study area.
5. To identify the locations where continuing education activities for employed scientists and engineers are being conducted in the study area.
6. To assess the unmet continuing education needs and specific subjects desired by employed scientists and engineers in the study area.
7. To identify the incentive systems used by industries in the study area to motivate employed scientists and engineers toward continuing education opportunities.
8. To investigate the educational materials, facilities and equipment used by industry in the study area to support continuing education programs for employed scientists and engineers.

Chapter II

Project Methodology and Activities

The first activity was to recruit three graduate students who were able to conduct interviews and construct questionnaires. The University of Wisconsin-Oshkosh's department of psychology and College of Business Administration were contacted to recommend graduate students who could effectively perform these tasks. Four industrial psychology students applied for the graduate assistant positions.

Assistant Vice Chancellor for Continuing Education, John W. Schmidt, and the NSF Project Director, W. Sam Adams, interviewed these applicants. Based on previous experience, education, and interest in the project, the following students were selected: Timothy Braulick, Bruce Knox, and Brian Tyler. The former two were second year graduate students, while the third was a first year student in the M.S. in Psychology program at the University of Wisconsin-Oshkosh.

Study Parameters

The Classified Directory of Wisconsin Manufacturers was the principal reference for identifying the study companies. It lists about 94 per cent of all industrial workers and about 6500 firms. This reference classifies industries by group numbers according to definitions established by the Standard Industrial Classification (SIC) Manual, published by the U.S. Bureau of the Budget. The criteria for study companies were: employed engineers and scientists, located in the upper three quarters of Wisconsin and employed fewer than 500 people.

The following procedural steps were taken systematically to select 30 small geographically dispersed industries located in central and northern Wisconsin.

Criterion #1. To define the study geographical area, the state's 72 counties were divided into those falling in the upper three quarters, and lower one quarter. Table 1 shows the 51 counties which had boundaries partially or totally inside the study area, and the sampling distribution.

TABLE 1

Counties Located in Upper Three-Fourths of Wisconsin and Percentages of Small Industries Meeting Study Criteria

County	Population	Sample	County	Population	Sample
Adams	.3%	0%	Marinette	1.6%	6%
Ashland	.6	0	Marquette	.2	0
Barron	1.9	2	Monroe	1.1	0
Bayfield	.3	2	Oconto	1.6	2
Brown	10.2	10	Oneida	.9	2
Buffalo	.3	0	Outagamie	6.3	6
Burnett	.4	0	Pepin	.2	2
Calumet	2.2	2	Pierce	.8	2
Chippewa	2.4	2	Polk	1.2	2
Clark	2.3	2	Portage	1.6	2
Door	1.1	0	Price	.6	0
Douglas	1.3	2	Rusk	.8	0
Dunn	.6	2	St. Croix	1.7	2
Eau Claire	2.5	2	Sawyer	.4	0
Fond du Lac	5.1	4	Shawano	1.2	0
Forest	.1	0	Sheboygan	6.3	6
Green Lake	1.2	2	Taylor	.3	0
Iron	.1	0	Trempealeau	1.2	0
Jackson	.3	2	Vernon	.6	0
Juneau	1.2	2	Vilas	.6	0
Kewaunee	1.0	0	Washburn	.4	0
La Crosse	3.8	4	Waupaca	3.1	2
Langlade	.9	2	Washara	.8	2
Lincoln	1.9	2	Winnebago	9.0	8
Manitowoc	5.0	4	Wood	3.3	2
Marathon	5.8	6		100%	100%

Review of this distribution indicated the sample was representative of the population even though the very small counties were not selected for study.

Criterion #2. Dr. Jerald Levy, research psychologist, Battelle Columbus Laboratories, Columbus, Ohio, was consulted on SIC codes which are representative of firms most likely to employ scientists and engineers. These codes and the distribution are shown in Table 2.

TABLE 2

Standard Industrial Classification (SIC) Categories
& Percentages of Small Industries Meeting Study Criteria

Code #	Category	Population	Sample
20's	Food & Kindred Products	18.2%	18%
24's	Lumber & Wood Products	4.6	6
26's	Paper & Allied Products	5.4	6
27's	Printing & Publishing	12.0	3
28's	Chemicals & Allied Products	2.8	3
29's	Petroleum & Coal Products	.3	3
30's	Rubber & Misc. Plastics Products	4.6	4
32's	Stone, Clay & Glass Products	6.9	0
33's	Primary Metal Industries	3.6	6
34's	Fabricated Metal Products	11.9	19
35's	Machinery, except Electrical	20.5	20
36's	Electric & Electronic Equipment	2.8	6
37's	Transportation Equipment	3.4	3
38's	Instruments & Related Products	1.6	0
48's	Communication	.1	0
73's	Business Services	.3	0
89's	Miscellaneous Services	1.1	3
		100%	100%

The results of the sampling were discussed with Dr. Gerald Levy and Dr. Gene D'Moore, NSF Project Officer. Both indicated the SIC sample was adequate and sufficient to proceed to the next sampling stage.

Criterion #3. Using the Classified Directory of Wisconsin Manufacturers each of the 51 studied counties was reviewed to determine those firms which met the SIC codes criteria and employed 500 or fewer people. Those companies not

listing employee size were eliminated from further consideration. A total of 1266 companies qualified according to these criteria. The population parameters showed that over two-thirds (71%) of the companies employed 50 or fewer people. Since an objective of the project was to include companies of all sizes up to 500 employees, a decision to under-represent very small size companies was made. This decision was endorsed by Levy and D'Moore. The distribution of company size for the population and sample is reflected in Table 3.

TABLE 3

Size of Company (Total Employees) Distribution of Small Industries Meeting Study Criteria

Company Size Intervals	Population	Sample
0-50	71.0%	26%
51-100	11.8	23
101-150	6.0	12
151-200	4.0	15
201-250	2.0	3
251-300	1.8	6
301-350	1.0	0
351-400	1.0	6
401-450	.5	3
451-500	1.0	6
	100%	100%

The sample of companies by size of employees was well distributed across all intervals of company size. The only interval not sampled was 301-350 which was expected since four intervals had frequencies of only one per cent of the population.

Sample Procedure

The study proposal required that the sample industries be representative of the small geographically dispersed industrial population. To insure at least 30 companies would participate, Dr. Gerald Levy recommended that 50 firms be initially selected since all these firms would not agree to take part in the study.

The first step in sampling was to choose 50 companies in the 51 study counties which met the study SIC codes and employee size criteria. Using the Classified Directory of Wisconsin Manufacturers, each county's qualified companies were listed. A table of random numbers, from a standard statistical text, was used to select the final sample.

In the SIC distribution, several categories were not represented because of the small sample size, e.g. communication, business services, instruments and related products, and stone, clay and glass products. Also, the sampling procedure slightly over and under-represented several SIC categories, e.g. fabricated metal products and printing and publishing respectively.

The sampling procedure resulted in 51 small geographically dispersed industries located in central and northern Wisconsin. Appendix A-1 lists the firms, names, and number of employees, SIC codes, main products and location.

Initial Contact

To interest companies in participating in the study, a letter personally addressed to each corporate head was mailed from the University of Wisconsin-Oskhosh Chancellor, Edward M. Penson. The December 1978 letter introduced the project director, Dr. W. Sam Adams, and explained the importance of the study to small companies. A follow-up letter was sent by the project director a few days later elaborating on the objectives of the study and attaching a project summary which was taken directly from the study proposal.

During late December 1978 and early January 1979 the project director telephoned each corporation head to determine the company's willingness to participate in the study, and to make arrangements for an orientation conference to answer questions about the project, ask when project staff could visit each firm, and what corporation officers should be interviewed.

After contacting each corporation, 20 chose not to participate. The reasons why each firm did not agree to participate are briefly noted in

Appendix A-2. The main categories for company non-participation are indicated in Table 4.

TABLE 4

Main Reasons 20 Firms Did NOT Want to Participate in Study

Reasons	Number of Firms
Unable to reach chief administrative officer	6
No or too few S/E employees	11
Study not appropriate or too busy for study	3
	20

Regional Conferences

The 31 remaining companies agreeing to participate in the study were invited to meet with the project staff at a location near their facilities. Originally, all participants were to come to Oshkosh for a project orientation session and a luncheon on the University of Wisconsin-Oshkosh campus. However, after discussions with corporation heads, it was agreed that it was more convenient for company representatives to meet at a site close to their place of business.

Five regional conference sites were identified in the study area: University of Wisconsin Center-Sheboygan; University of Wisconsin-Oshkosh; University of Wisconsin-Green Bay; University of Wisconsin Center-Marathon County; and University of Wisconsin-Stout. The conferences were held in early February 1979 and of the 31 companies invited, 26 attended and the remaining five were visited and delivered conference materials in person at their plant sites.

The conference materials handed out included:

1) NSF Conference Review Sheet - an instruction sheet providing the conference attendee with areas to be covered in the President's interview and requesting him to distribute several questionnaires to selected employees.

2) NSF Study Definitions - these are key terms and parameters used in the study.

3) Company Policy Questionnaire - an instrument used to gain information about continuing education policies and reimbursement plans.

4) Scientists/Engineers, Technicians and Technologists Questionnaire - an instrument which was used to solicit date from company technical personnel. Each company representative was asked to specify how many persons met the NSF study definition categories and that number of instruments was given to the representative at the conference.

5) Presidents Qeustionnaire - an instrument to assess each corporation head's perspectives on certain continuing education issues, work group organization, product changes, technological problems and procedures used to solve problems.

6) Interview sheet - this sheet requested conference participants to list name and positions of people to be interviewed.

In addition to interviewing each company president, two to five other key management and top line technical supervisors having major responsibility for the operation of the company were asked to be interviewed.

Site Visitations

During the months of February, March and April 1979 sample companies were visited by project staff. Scheduling site visits in a region was a problem since corporation officers were quite busy; therefore, it was difficult to organize visits to a number of companies in a two or three day period. However, in most cases, this was accomplished without an exorbinated amount of project staff "slack time".

Three companies prior to visitation indicated they could not participate further in the study: Northwestern Motor, Eau Claire; Durand Canning Company, Durand; and Sargento Cheese, Plymouth. Their reasons varied, but the main one was lack of time for company officers to be interviewed.

Instruments Design

In order to assess scientists and engineers experiences about their interests in continuing education, interview instruments and questionnaires were designed. The process for developing valid and reliable instruments was lengthy and exhaustive.

Phase I

One of the first tasks was to refine the definitions of scientists and engineer so the terms were operational and applicable to area industries. Since paper is a significant industry in Wisconsin and firms employ large numbers of technical people, the Technical Association of the Pulp and Paper Industry (TAPPI) was the first organization contacted. The Lake States section of TAPPI invited the project director to an executive committee meeting October 25, 1978 in Wausau to discuss definitions and size of companies to be sampled. Two TAPPI officers, Chairman Lloyd Mekela and Vice Chairman Kelly Knutson, suggested expanding the scientist and engineer definition to technicians because of the crucial need for continuing education for people without college degrees.

On November 15, 1978, Dr. Adams met with Dr. John Klus, Chairman, Department of Engineering and Applied Sciences, University of Wisconsin-Extension in Madison to discuss the project goals. Dr. Klus has been a frequent NSF grant recipient involving studies of scientists and engineers continuing education, and his advice on the project was extremely valuable. Several of his questionnaires served as invaluable instruments for designing this project's instruments.

On November 15, 1978, Mr. Fred Disch, Personnel Wage Specialist, Kimberly-Clark Corporation, Neenah, Wisconsin, discussed, with project staff, the accepted job duties and positions of scientists and engineers employed in industry. He provided advice on how to interview corporation executives and suggested specific items for questionnaires. He also discussed levels of supervisory responsibility and job descriptions of technical people employed in industry.

Phase II

The National Science Foundation requested the five project directors receiving awards in continuing education for small or dispersed industry to meet November 21, 1979 at Battelle Columbus Laboratories. The purpose was to coordinate the five grants as much as feasible through common agreement on definitions, terminology, data collection processes, instrumentation and sampling plans and procedures. The outcome of the meeting was a common set of definitions and parameters, project activities, and future coordination plans. A summary of the NSF Project Directors meeting is included in Appendix A-3.

Phase III

Since the project graduate students had not had extensive practical experience with interviewing, several workshops were proposed. Mr. Roger Westphal, Acting Director of Career Placement and Planning, University of Wisconsin-Oshkosh, designed three sessions to help the students construct an effective interview instrument and allow them to practice interviewing in hypothetical settings. Appendix A-4 provides an outline of the topics covered in the interview workshop.

During the same period, the project staff began constructing questionnaires for eliciting information on items which were appropriate for interviews. Mr. Westphal advised that interviews should consist of statements requiring judgement and perspective on the part of the respondent. Questionnaire items, on the other hand, should stress specific detail questions which could be answered easily and quickly. In both types of data gathering instruments, many of the items were drawn from Battelle Columbus Laboratories and University of Wisconsin-Extension questionnaires.

Draft copies of each instrument were sent to Dr. Klus, Dr. D'Moore, Mr. Disch, Mr. Westphal, Dr. Schmidt and the five NSF project directors for comment and review. To insure all questions and statements used were pertinent to the

project objectives, a matrix indicating instrument items and project objectives was designed. Table 5 illustrates this matrix.

Final instruments were pilot tested in January 1979 using three Oshkosh companies: Sorgel Electric, Lenox Candle and Muza Metal. The staff graduate students conducted interviews and submitted questionnaires to employees of these firms. Their responses provided valuable input into the final revisions of all the company instruments used which are included in Appendix A-5.

Phase IV

In addition to sampling small industries about their involvement in continuing education, the project also set out to inquire about what continuing education offerings and activities are being performed by technical and professional associations and post-secondary institutions in the study area.

TABLE 5

Instruments and Project Objectives Matrix

Goals (Abbreviated)	Company Interview/ Instrument	Company Presidents Question.	Company Sci./Engin. Question.	Company Policy Question.	Prof. Assn. Interview Instrument
Demographics		1,5,9	1-4, 7-9 14		
Available C. E. opportunities in this area	1,3,4,7	2	5,10,11		1
Organizations which provide C. E. courses in area	3,4,7,8		12,15,17 19,21,6		1
Types of C. E. delivery system used by industry in area	1,3,4,7	2	5,10,15 17,19,21	10,11	1
C.E. accessibility in area & where C.E. is offered	1,3,4 6,7	2	15,17 19,21	10,11	1,3
Unmet C.E. subjects need to be provided	3,6,9		16,18 20,22		2,3
Incentive systems used for C.E. participation	2,5	3,4	13	1,2,3,4,5 6,7,8,9	
Education materials & equipment used by industry	1,3,4,7		5,10	10,11	

Several approaches were employed to reach professional associations of engineers and scientists. The purpose was to obtain information about educational or training program offerings they currently were offering and were planning for in the future, and to determine need for engineering programs in study area (Central and Northern Wisconsin). Names of 47 associations were obtained from TAPPI officers, Dr. Klus, and interviewees during company interview visits. A list of these associations is shown in Appendix A-6.

The initial contact with professional associations was through a letter informing officers about the project and requesting their participation in a phone survey. Thirty-four associations had officers who could be contacted by phone, and the staff was able to complete 23 interviews. In order to achieve a higher response rate, 19 associations were sent letters asking officers to complete a short questionnaire of which six responded. Five associations were not able to be reached either by phone or letter. Appendix A-6 provides sample instruments used in obtaining association data.

Phase V

The technical programs offered in Wisconsin's post-secondary institutions were reviewed. These institutions included Wisonsin Vocational, Technical and Adult Education System (VTAE), University of Wisconsin (2-year) Center System, Wisconsin independent colleges and universities, University of Wisconsin System, and University of Wisconsin-Extension's, Department of Engineering and Applied Science. In addition, technical and non-technical programs provided by professional and trade assiciations and industry itself were analyzed. A list of scientific and engineering program and non-technical offerings for each of these organizations are summarized in Appendices B-1 through B-9.

Chapter III

Study Results

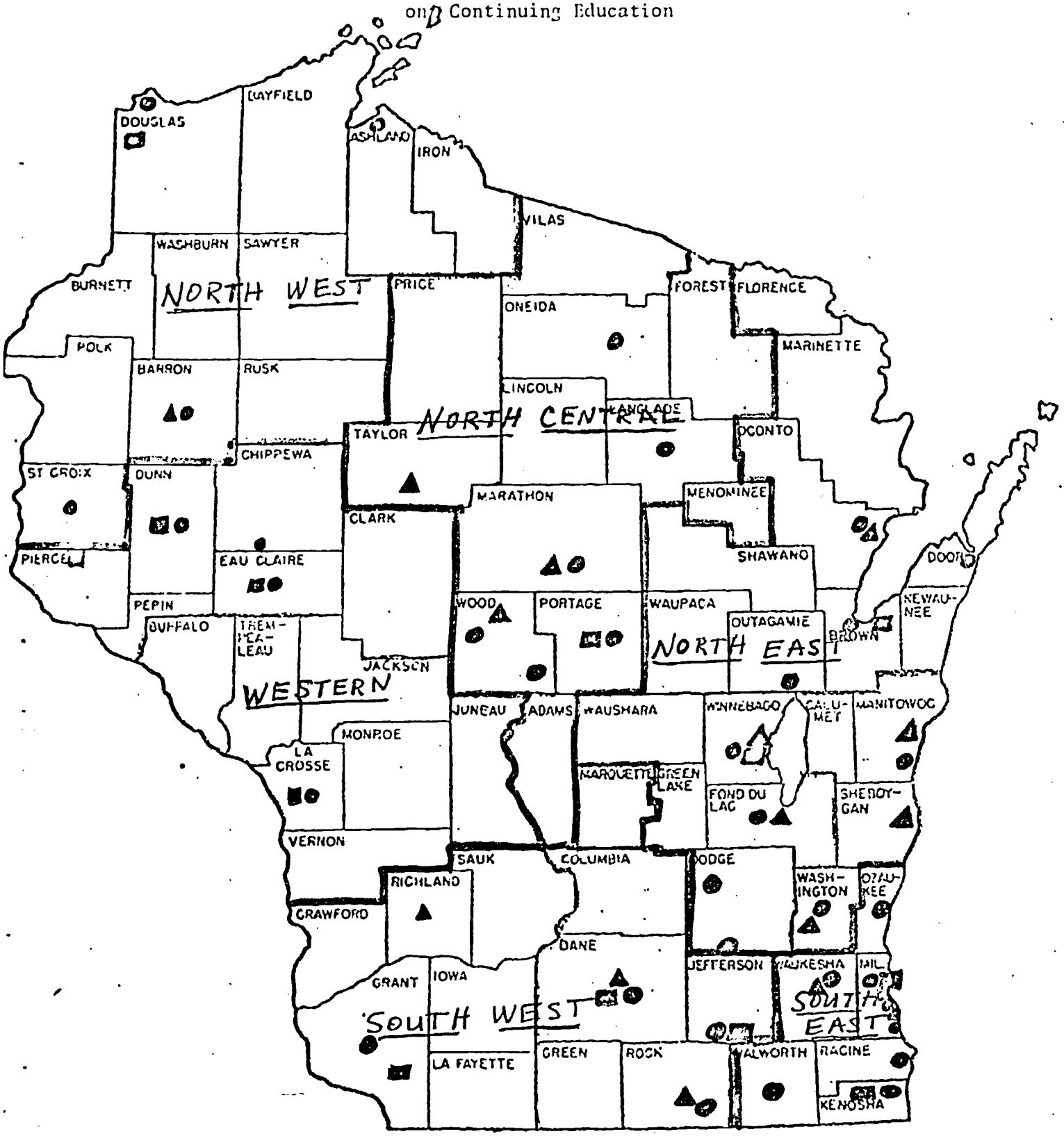
An important aspect in interpreting the results of any study is knowing the parameters and characteristics of the population and participants. The sample industries have already been defined by SIC company size and location in Chapter II, and are detailed in Appendix A-1. In order to discuss and assess industrial location and continuing education accessibility in Central and Northern Wisconsin a number of geographical areas need to be identified. The most acceptable method is to adopt an existing structure which is well recognized. Since this study is concerned with post-secondary education, regardless of what organizations delivered the instruction, the Joint Administrative Committee on Continuing Education (JACCE) regional map was used to help define the areas for the study. JACCE combines all Wisconsin public higher education institutions into one advisory group, i.e., the 13 four-year campuses and 14 two-year campuses of the University of Wisconsin System and the 38 main campuses of the Vocational, Technical, and Adult Education System. There are distinctive mission differentations among institutions, especially between the UW System and VTAE System. These differences will be explained later under the study section dealing with the continuing education opportunities. (pp. 23-27)

The purpose of JACCE is to facilitate planning in the area of continuing education in six regional councils, in order to give great autonomy and responsibility for dealing with problems of coordination which are local in nature. At the state level the committee serves to provide clarification in cases that extend over several regions, and to develop recommendations for statewide policy.

The regional council areas are shown in figure 1. The study area encompasses four of the areas, i.e., North West, North Central, Western and North East. Public post-secondary institutions are also identified on the map.

Figure 1

JACCE REGIONAL AREAS UW-VTAE Joint Administrative Committee on Continuing Education



▲ UW centers (2 yr.)

■ UW campuses (4 yr.)

● VTAE campuses

As discussed in Chapter II, there are about 6500 industries identified in the Classified Directory of Wisconsin Manufacturers. Table 6 shows the number and proportion of the total state industrial population and the sample companies in each JACCE area. Over half (52%) of all Wisconsin industries are located in the southern one-quarter of the state, which indicates the high concentration of industry in this area.

TABLE 6

Wisconsin Industrial Population & Study Sample Industries

JACCE Areas	Industrial Population		Sample Companies		Study Area Industry Population	
	#	%	#	%	#	%
In Study Area:						
North West	253	4	2	7	253	8
North Central	449	7	5	16	449	15
North East	1844	28	19	61	1844	59
Western	568	9	5	16	568	18
Total In Study Area	3114	48%	31	100%	3114	100%
Outside Study Area:						
South West	729	11				
South East	2662	41				
Total Outside Study Area	3391	52%				
GRAND TOTAL	6505	100%				

Table 6 also illustrates the representativeness of the sample is of the total industrial population. However, it should be cautioned that the study sample excluded companies larger than 500 employees. Therefore, the sample and the industrial population have similar proportions for the number of companies but dissimilar proportions for the size of companies.

Types of Industry Fields

Besides identifying these firms by SIC index in Chapter II, company presidents were asked what field of engineering and applied science were their people primarily engaged in. Thirty respondents indicated many technical activities, but the highest frequencies were in mechanics, design, and industrial fields; a particularly interesting fact was 17 presidents said their company was principally involved in research and development work. Since companies are engaged in numerous technical activities, the total number of responses in Table 7 aggregate to more than the number of respondents.

TABLE 7

Fields of Engineering & Applied Science that Scientists & Engineers are Primarily Engaged in (N=30)

Field	Number of Responses	Field	Number of Responses
Chemical	9	Standards	1
Design	20	Procedures	1
Electrical	12	Food Processing	1
Industrial	18	Structural	0
Mechanical	23	Maintenance	1
Paper (Pulp)	4	Ferrous & Nonferrous Metals	1
Plastics	4	Foundry	1
Process	14	Metal Working	2
Research & Development	17	Electronic	0
Architectural	2	Civil	2

Respondents Characteristics

The background of respondents are important to understand for the purposes of interpreting their attitudes and experiences relating to continuing education. The demographic data on interviewees and questionnaire respondents are discussed in this section.

Top Management

Thirty company presidents or their representatives chose up to three top management people to be interviewed, in addition to themselves. Selection of key company personnel was verified by the respondents' level of supervisory responsibilities shown in table 8. These 116 people, therefore, would appear to have a good understanding of the company's and employees' continuing education needs and activities. No other demographic data was elicited from top managers and no data was collected on presidents or their representatives as a unique group.

TABLE 8

Top Manager's Level of Responsibilities

Title/Position	Interviewed	% Interviewed
No Supervisory Responsibility	9	8
Supervision of Technicians and/or Non-technical Personnel	41	35
Supervision of Engineering and/or Scientific Personnel	13	11
Management of a Major Department, Division, or Program	29	25
General Manager of an Organization	24	21
TOTAL	116	100%

Middle Management

In addition to selecting interviewees, company presidents were asked to distribute scientists and engineer questionnaires to their key technical people. These included 192 scientists, engineers, technologists and technicians who held primarily middle management positions. About three-fourths of the respondents had some supervisory responsibilities.

TABLE 9

Middle Manager's Level of Supervisory Responsibility

Supervisory Responsibility	# of Responses	% of Responses
No Supervisory Responsibility	46	24
Supervision of Technicians and/or Non-Technical Personnel	75	39
Supervision of Engineering and/or Scientific Personnel	27	14
Management of Supervisory Personnel	19	10
Executive (Upper Management)	21	11
No Response	4	2
TOTAL	192	100%

Middle managers were asked to describe their highest current level of technical responsibility. Over half indicated they performed technical work rather independently under general supervision by others, whereas 44 per cent said they received specific directions from supervisors.

TABLE 10

Middle Manager's Level of Technical Responsibility

Technical Responsibility	# of Responses	% of Responses
Perform limited assignments with specific direction under an experienced Engineer or Scientist	8	4
Perform assignments with limited directions, with a general review of work done	21	11
Independently perform most work with directions only to general results expected	60	31
Independently work in extending known techniques, data, etc.	23	12
Technical direction and review of work performed by others	76	40
No Response	4	2
TOTAL	192	100%

Another characteristic of small company middle managers is their level of formal education. Most respondents (68%) had some post-secondary education in their technical field. About one-third of the middle managers had a bachelor's degree and 9 per cent had a post graduate degree.

TABLE 11

Middle Manager's Highest Degree Earned

Degree	# of Responses	% of Responses
High School Diploma	61	32
Associate or Technical Degree	29	15
Bachelor's Degree	70	36
Master's Degree	12	6
Ph.D./Ed.D./M.D.	5	3
Certification	3	2
No Response	12	6
TOTAL	192	100%

The fields of applied science and engineering middle managers were engaged in were quite diverse. As might be expected, small industry technical employees spend most of their time in mechanical and industrial activities. However, about 17 per cent of the respondents said they were involved in research and development work. Since an employee may be working in more than one technical area, Table 12 percentages accumulate to more than 100 per cent.

TABLE 12

Middle Manager's Areas of Work

Field of Work	# of Responses	% of Responses
Mechanical	82	43
Industrial	74	39
Design	54	28
Electrical	40	21
Chemical	35	18
Process	35	18
Research & Development	33	17
Plastics	28	15
Paper (Pulp)	22	12
Civil Engineering	5	3
Computer Science	2	1
TOTAL	410	N.A.

Middle Managers were asked how many years they had worked as a scientist, engineer, technologist, or technician. Interestingly, many of these people are relatively new to this type of industry. Almost half (44%) of the respondents have been employed ten years or fewer in technical jobs.

TABLE 13

Years Middle Managers Have Worked in Technical Jobs

Years Employed	# of Responses	% of Responses
1 - 5	44	23
6 - 10	41	21
11 - 15	25	13
16 - 20	26	14
21 - 25	8	4
25 - 30	8	4
31 - 35	6	3
36 - 40	6	3
No Response	28	15
TOTAL	192	100%

One of the informal ways for scientists and engineers to further their education is to read professional and trade journals. When asked how often middle managers read technical publications, about three fourths said they read one to three on a regular basis.

TABLE 14

Frequency With Which Middle Managers Read Scientific Journals or Periodicals on a Regular Basis

Frequency	# of Responses	% of Responses
Do Not Regularly Read Any	44	23
Read One Regularly	35	18
Read Two Regularly	40	21
Read Three or More Regularly	68	35
No Response	5	3
TOTAL	192	100%

Another way people gain valuable information relating to their jobs is through communications with people in the same speciality. Middle managers were asked how many colleagues "in other organizations" they exchanged technical information with on a regular basis. Over a third of the respondents indicated they contacted associates frequently, and another fifth said they did so four or more times on a regular basis.

TABLE 15

Number of Colleagues In Other Organizations With Whom Middle Managers Exchange Scientific or Engineering Information on a Regular Basis

Number of Colleagues	# of Responses	% of Responses
None	77	40
One to Three	71	37
Four or More	37	19
No Response	7	4
TOTAL	192	100%

Applied Science & Engineering Continuing Education Opportunities

The first and possibly the most fundamental objective of the project was:

> To determine existing continuing education opportunities for employed scientists and engineers in the study area.

The data gathered were mainly derived from existing program materials obtained from post-secondary educational institution, professional and trade associations, and industry itself. Anyone questioning whether or not the state of Wisconsin provides a comprehensive continuing education program in applied sciences and engineering need only review Appendices B-1 University of Wisconsin System, B-2 University of Wisconsin Center System, B-3 and B-4 Vocational, Technical and Adult Education System, B-5 Independent Wisconsin Universities, B-6 and B-7 Professional and Trade Associations, and the discussion in this section on University of Wisconsin-Extension. This section of the report discusses the opportunities available; other sections deal with scientists and engineers continuing education participation.

Before discussing post-secondary opportunities in Wisconsin, clear statements about each type of institution's mission should be made. Mission differentation is important because an institution which may be close in proximity to a company may not have science or engineering programs since it has not been changed to offer these programs.

The University of Wisconsin System and the Vocational, Technical and Adult Education System established a Joint Administrative Committee on Academic Programs (JACAP) to clarify and monitor mission differentation between the systems. In July 1974 JACAP received a request to define the the term "occupational" as it was used in several UW institutions mission statements. As defined by University of Wisconsin System 1971 merger law (Chapter 100, Sec. 11),

> "the UW System shall not broaden the system's post-high school collegiate training mission to include the preparation of persons for semi-professional or skilled trade occupations beyond those offered during the 1971-72 academic year unless approved by the board of vocational, technical and adult education."

Also articulated in the merger law (Chapter 100, Sec. 15) "the board (WB VTAE) shall be responsible for the initiation, development, maintenance and supervision of programs with specific occupational orientations below the baccalaureate level, including terminal associate degrees, training of apprentices and adult education below the professional level."

As these statements apply to this study, the UW System institutions may offer "professional" programs for scientists and engineers to culminate in a baccalaureate degree or higher degree whereas the VTAE system may provide programs for the technician which are below the baccalaureate degree. There are distinct mission differences between every higher education institution in Wisconsin which are clearly stated; it is beyond the purview of this study to specifically identify each one. However, in considering the following opportunities section of the report, the reader should be aware some of the results may be affected by mission differentation.

University of Wisconsin System

The 13 University of Wisconsin System four-year campuses (undergraduate/graduate studies) currently offer 170 degree programs in applied sciences and engineering. Of these, three-fourths are offered outside the study area, i.e., in Southern Wisconsin. Also, practically all (92%) graduate programs are available outside the study area. This may be due to the high concentration of large industries and city populations in the southern part of the state.

TABLE 16

UW System Applied Sciences & Engineering
Degree Programs by Study Area

Location	# Bachelor	# Master & Plus 1 Yr.	# Doctorate	TOTAL #	TOTAL %
In Study Area:					
North West	5	-	-	5	3
North Central	4	1	-	5	3
Western	19	4	-	23	13
North East	9	1	-	10	6
Subtotal	37	6	-	43	25
Outside Study Area:	55	40	32	127	75
TOTAL	92	46	32	170	100%

A comparison of the number of UW System applied science and engineering degree programs to Wisconsin industries population, by study area, is shown in Table 17. These are gross indicators which need further refinement, but there appears to be several misrepresentations of number of applied science and engineering programs to number of companies. These data indicate that the number of technical degree programs in southern Wisconsin are over representative for the number of industries in this area when compared to central and northern Wisconsin. In northeast Wisconsin, there are proportionately more companies (28%) than degree programs (6%). These data do not take into consideration the size of the companies so there may be justification for a larger number of scientists and engineering programs in the southern part of the state.

TABLE 17

UW System Applied Sciences & Engineering Degree Programs and Wisconsin Industrial Population by Study Area

Location	Programs		Companies	
In Study Area:	#	%	#	%
North West	5	3	253	4
North Central	5	3	449	7
Western	23	13	568	9
North East	10	6	1844	28
Outside Study Area:	127	75	3391	52
TOTAL	170	100%	6505	100%

University of Wisconsin-Center System

All 14 of the University of Wisconsin-Center System two-year campuses offer an associate degree in the sciences. Generally these programs are preparatory or general education, and therefore are pre-professional. No specialization in a particular field is available. There are special courses which employed scientists and engineers can enroll in to meet professional and personal interests, but no distinctive area of expertise is offered. Appendix B-2 shows the associate arts & science degrees at each UW-Center by study area location, and Table 18 indicates the number of campuses in and outside the study area. Because the UW-Center System institutions do not have a mission to offer technical degree programs, comparisons with number of industries probably is not appropriate.

TABLE 18

UW Center System Associate of Science & Arts
Degree Programs by Study Area

Location	Arts & Science Degree Programs	
In Study Area:	#	%
North West	1	7
North Central	3	21
Western	0	0
North East	6	43
Subtotal	10	71
Outside Study Area:	4	29
TOTAL	14	100%

Vocational, Technical and Adult Education System

The Wisconsin VTAE System consists of 16 districts with 38 main campuses and a wide array of technical programs. The programs include an associate degree and three diploma program levels: a) Short Term (less than one year) b) One-year Diploma and c) Two-year Diploma. Associate degree programs are two years in length and require a student to complete a technical or college parallel education program. The diploma programs are designed to provide students with skills for entry into and advancement within occupations requiring a high proportion of manipulative skills and knowledge of methods and techniques. Other programs which are preparatory to diploma and degree programs are also available to students in developmental studies and adult basic education.

Since this study's primary thrust is on technical opportunities in the applied sciences and engineering, only the 344 diploma and associate degree VTAE programs in Trade and Industry were reviewed. Appendix B-3 includes a list of these programs by geographical area, and Table 19 summarizes these opportunities inside and outside the study area.

About three-fifths (or 198) of the Trade and Industry VTAE programs are offered in the study area, in contrast to 25 per cent of UW System technical degree program offerings. The one-year diploma programs represent approximately half of all trade & industry programs, and another one-third are associate degree programs.

TABLE 19

VTAE Trade & Industry Programs by Study Area

	Number of Programs					
	Vocat. Dipl.	One-yr. Dipl.	Two-yr. Dipl.	Assoc. Deg.	TOTAL	
In Study Area:					#	%
North West	4	16	4	4	28	8
North Central		20	9	11	40	12
Western		19	6	16	41	12
North East	4	53	6	26	89	26
Subtotal	8	108	25	57	198	58
Outside Study Area:	10	65	14	57	146	42
TOTAL	18	173	39	114	344	100%

When comparing Trade and Industry programs to Wisconsin's industrial population, the VTAE system seems to be offering programs in about the same proportion as the number of companies. Table 20 shows these proportions by areas. If anything, the VTAE programs are slightly over representative in the northern and western areas of the state for the industry population.

TABLE 20

VTAE Trade & Industry Programs and Wisconsin Industrial Population by Study Area

Location	Programs		Companies	
In Study Area:	#	%	#	%
North West	28	8	253	4
North Central	40	12	449	7
Western	41	12	568	9
North East	89	26	1844	28
Outside Study Area:	146	42	3391	52
TOTAL	344	100%	6505	100%

Wisconsin Independent Universities

There are 21 independent four-year colleges or universities in Wisconsin. Of these about half (10) are located inside the study area. Appendix B-5 shows a display of institutions by regional location and technical degree offerings. Table 21 summarized the applied sciences and engineering programs in and outside the study area.

About one-third (36%) of all technical degree programs are in the study area, and most of these are located in North East Wisconsin. Fifty per cent of the graduate programs are inside the study area. However, all these programs are offered in the North East area, and by one institution, the Institute of Paper Chemistry in Appleton, Wisconsin.

TABLE 21

Wisconsin Independent Universities Applied Science & Engineering Programs by Study Area

Location	Certificate Programs	Associate Degrees	Bachelor's Degrees	Master's Degrees	Doctorate Degrees	TOTAL #	TOTAL %
In Study Area:							
North West	-	-	5	-	-	5	5
North Central	-	-	-	-	-	0	0
Western	-	-	2	-	-	2	2
North East	-	-	16	7	7	30	29
Subtotal	-	-	23	7	7	37	36
Outside Study Area:	3	10	38	9	5	65	64
TOTAL	3	10	61	16	12	102	100%

The independent colleges and universities applied science and engineering programs are approximately proportional to the number of industries in the North West and North East areas. However, in the other areas of the state, they are not representative. There is over representation of programs in the Southern area and under representation in the North Central (where there are no programs) and Western areas.

TABLE 22

Wisconsin Independent Universities Applied Sciences & Engineering Programs and Wisconsin Industrial Population by Study Area

Location	Programs #	Programs %	Companies #	Companies %
In Study Area:				
North West	5	5	253	4
North Central	0	0	449	7
Western	2	2	568	9
North East	30	29	1844	28
Outside Study Area:	65	64	3391	52
TOTAL	102	100%	6505	100%

University of Wisconsin-Extension

The University of Wisconsin-Extension has had a history of being the primary source of continuing education for the public and has served as a resource center for university service to the rural and urban communities of the state. The Department of Engineering and Applied Science, located in Madison, Wisconsin, annually enrolls nearly 18,000 people in Engineering programs, short courses, evening classes, electromedia programming and independent study. Electromedia programming is the departments "off campus" arm, and consists of the Statewide Extension Education Network (SEEN), the Educational Telephone Network (ETN) and Video Cassette Courses (VCC). The number of programs which have been available in the study area via various delivery systems are shown in Table 22A and specific course titles are listed in Appendix B-8.

TABLE 22A

UW-Extension Applied Science & Engineering Programs
Offered 1976 - 1980

	Number of Programs
SEEN	43
ETN	6
VCC	7
Short Courses	19
Independent Study	103
Technical Courses	6

Engineering institutes and workshops provide two or three day continuous programs. They usually cover current developments in the field, and are offered only in Madison, Wisconsin. One-third of all engineering programming are short courses which usually run one week. These courses are conducted by a team of UW-Extension engineering faculty from Madison and Milwaukee, along with instructors from other universities and experts from industry and private

practice. While most of the short courses are offered in Madison, some are taught at industrial sites. Also there are extensive independent study offerings in engineering and applied sciences which provide self-study opportunities for scientists and engineers throughout the state.

The electromedia systems have been important developments for delivery of all continuing education in Wisconsin.

SBBN was developed in 1969 and has 23 sites where participants can receive instruction. SBBN is a four-wire party line featuring immediate communications between instructors and students. Delivery of instruction is made by means of desk microphones and classroom loudspeakers. Also, an electrowriter permits transmission, reception, and projection of diagrams, formulae, outlines, etc. ETN originated in 1965 and has over 200 sites throughout Wisconsin. It is a two-way telephone system where instructor and participants at various locations may communicate with one another. VCC are courses which allow anyone having the necessary cassette player and television set to participate in continuing education. VCC lessons are combined with special text materials, and are between 20 and 30 minutes in length. The tapes are produced by UW-Extension's WHA-TV studios.

Finally, UW-Extension and the Vocational, Technical and Adult Education System are conducting a project for developing correspondence courses for VTAE credit. Of the 14 courses listed in the 1979-80 UW-Extension Independent Study catalog, there is one course, "Materials of Industry", which would be of interest to scientists and engineers.

Professional and Trade Associations

It was difficult to determine what applied science and engineering associations should be included in the study. As stated in Chapter II on sampling procedures, most of these groups were identified from interviewees. Some associations were organized only nationally, others had regional, state, and/or local chapters. Attempts were made to contact each association's president or

program chairman via telephone interview and/or questionnaire. Appendices B-6 and B-7 show the technical and non-technical programs these groups have recently offered, and those planned for the future. Table 23 outlines association programs offered during 1976-1978 within and outside the study area.

TABLE 23

Technical & Non-Technical Programs Offered (1976-1978) by Professional or Trade Associations In & Outside Study Area (N=29)

	Technical	Non-Technical	TOTAL
Inside Study Area	56	9	65
Outside Study Area	33	18	51
Outside Wisconsin	27	26	53
Unknown	7	2	9
TOTAL	123	55	178

Of the 29 associations responding, 60 per cent of their programs were technical courses, and half of these were offered within the study area. Non-technical courses, on the other hand, tend (84%) to be delivered at sites outside the study area. This data indicates professional & trade associations provide many opportunities for their members to keep current in technical fields close to their places of residence, but general topics, e.g. supervisory training, are usually offered at regional and national meetings at considerable distances away from their homes. It would appear that local education institutions could fulfill much of the non-technical courses demand.

Most of the associations contacted could not give a clear indication of topics they would like offered in the future. Their explanation, almost universally, was their programs were developed a year or less in advance so they could provide the most current and critical topics of membership interest. Appendix B-6 and B-7 show the 26 technical and 19 non-technical programs some associations are planning on offering.

Continuing Education Participation

This section of the study addresses the project objective:

> "To identify the agencies, institutions, industries and professional associations which provide continuing education, credit and non-credit, courses in the study area."
>
> "To investigate the type of instructional systems currently being used by industry to deliver continuing education for employed scientists and engineers in the study area (e.g. self-paced, correspondence, lecture, workshop, seminar, laboratory, radio, T.V., telephone network, etc.)"
>
> "To assess the unmet continuing education needs and specific subjects desired by employed scientists and engineers in the study area."

Several instruments were used to obtain information on these objective. The top manager interviews and the middle managers questionnaire had items which directly dealt with continuing education participation and future continuing education needs.

In-Plant Programs

The type of work many of the sampled small industries were engaged in required continual training of personnel. These activities varied widely, but the great majority were technical and very specific to the task of the company. The most frequently mentioned in-house continuing education programs were informal and technical. Non-technical programs in contrast, were primarily offered at non-industrial sites. Table 24 includes more responses than the number interviewed because some top managers indicated several types of in-house programs.

TABLE 24
In-House Continuing Education Programs
Offered by Sample Industries (N=116)

Type of In-House Program	# Responding	% Responding
Informal & Technical	103	89
Formal & Technical	38	33
Informal & Non-Technical	7	6
Formal & Non-Technical	7	6
TOTAL	155	

Specific continuing education activities small industries have offered in-house are shown in Appendix B-9 by technical vs non-technical, and informal vs formal categories.

Subject Content

Top and middle managers were requested to provide specific continuing education subjects they and their employees had taken during 1976-1978, as well as recommend subjects they would like to see offered in the future (1979-1981). Since there were over 400 subjects mentioned, 14 topical categories were developed by UW-Oshkosh science faculty to make the list more manageable. A complete list of subjects by category are included in Appendix C.

The subjects most frequently participated in were technical in nature. Respondents also wanted more technical course offerings in the future. They wanted the proportion of technical course offerings increased from 64 per cent to 67 per cent. Furthermore, respondents would like 20 per cent more continuing education, regardless of subject area.

Only environmental engineering and pulp & paper technology were technical areas which respondents indicated they would like offered less frequently in the future. Although personal development also dropped slightly in overall demand, top managers felt more of these courses should be available. Similarly, business administration course interest was quite high among top and middle managers, even though the latter group suggested fewer courses were needed in the future.

TABLE 25

Continuing Education Subject Content Participated In and Wanted
As Viewed by Top Management (N=116) and Middle Management (N=192)

Top Categories	Top Management		Middle Management		TOTAL	
	# of Subjects		# of Subjects		# of Subjects	
Technical:	Taken	Wanted	Taken	Wanted	Taken	Wanted
Bio-engineering	5	11	2	0	7	11
Chemistry	7	24	7	5	14	29
Chemical Engineering	14	19	20	26	34	45
Computer Science	23	32	19	19	42	51
Electrical Engineering	8	13	9	14	17	27
Environmental Engineering	8	10	17	10	25	20
Industrial Engineering	18	48	38	29	56	77
Mechanical Engineering	13	23	18	32	31	55
Metallurgical Engineering	5	11	6	17	11	28
Physics (Eng. Mech/Math)	35	23	15	27	50	50
Pulp & Paper Technology	5	7	12	6	17	13
Vocational & Technology	38	47	19	20	57	67
Subtotal	179	268	182	205	361	473
Non Technical:						
Business Administration	67	117	80	60	147	177
Personal Development	22	35	36	18	58	53
Subtotal	89	152	116	78	205	230
GRAND TOTAL	268	420	298	283	566	703

Types of Continuing Education

When top managers were asked about the types of educational activities and delivery systems they and their employees participated in and what they would like in the future, college credit courses were more frequently mentioned than non-credit courses. The formats of delivery systems most favored were seminars, workshops and conferences.

Middle managers also tended to want credit courses more than non-credit courses, although the difference was less pronounced. In the questionnaire completed by middle management, no differentiation was made between seminars, conferences and workshops; however, as with top management, these types of delivery systems are very popular. A matrix of subject content and type of delivery systems used and desired by middle management are included in Appendix C-2.

One trend worth noting for both groups, is that credit and non-credit courses are increasing in interest, from 142 to 208, while seminars, conferences and workshops are decreasing, from 438 to 208. The overall decline between participation and future interest in the different types of continuing education probably is due to lack of preference for a particular delivery system rather than interest in continuing education.

TABLE 26

Types of Educational Activities and Delivery Systems
Which Top Management and Middle Management
Participated In and Want in the Future

Activity/ Delivery System	Number Responding: Top Management Participated	Top Management Want	Middle Management Participated	Middle Management Want
Credit Courses	102	131	40	77
Non-Credit Courses	19	40	54	64
Seminars	163	55		
Conferences	24	12	184*	117*
Workshops	67	24		
Organized Self-Study	22	3	20	25
Others:				
In-Service & Informal	18	4		
Evening Courses	0	12		
Publications	16	1		
TOTAL	431	282	298	283

*combination of seminars, conferences & workshops

Organizations Offering Continuing Education

The types of organizations, agencies and institutions offering continuing education in technical fields is quite varied. They range from higher education institutions to chambers of commerce. According to top management, over half (60%) of the continuing education they and their employees participated in were offered by non-educational organizations. Middle management, on the other hand, tended (52%) to be more involved in continuing education delivered by educational institutions than from other organizations.

Professional associations and manufacturers were the organizations respondents most frequently used to enroll for continuing education. Top managers and employees (77) tended to participate most in programs offered by manufacturers, while middle managers (55) attended programs most often provided by professional associations. A complete breakdown of both groups continuing education activities by organization type is shown in Appendices C-3 and C-4.

Participation in continuing education was reported higher during 1976-1978 than anticipated in 1978-81 (Table 27). This seems to contradict the subject demands shown in Table 25, however, this may be due to respondents not having a strong preference for the type of organization delivering programs, rather than their future interest in continuing education. There is a clear indication that both top and middle management would like continuing education provided more from educational institutions than from other organizations. There were 301 respondents who wanted future continuing education programming offered by colleges and universities in contrast to 95 interested in programs delivered by non-educational institutions.

The organization receiving the greatest increase in demand over previous participation was the University of Wisconsin System. Both top and middle management wanted to increase their participation (66 - 113) in UW institutions in their service area. These data also support the earlier finding that industries would like more credit courses offered in the future.

TABLE 27

Organizations Top Management and Middle Management
Participation In & Desire For Continuing Education by Organization Type

Organization	Top Management		Middle Management		TOTAL	
	Participation	Need	Participation	Need	Part.	Need
UW EXTENSION	10	19	10	5	20	24
UW SYSTEM (4-year)						
General	8	27	5	16	13	43
In Study Area	36	57	30	56	66	113
Outside Study Area	13	1	32	6	45	7
UW CENTER SYSTEM (2-year)						
General	0	0	0	3	0	3
In Study Area	5	8	9	23	14	31
Outside Study Area	1	1	0	0	1	1
VTAE (2-Year)						
General	10	19	3	2	13	21
In Study Area	47	43	25	8	72	51
Outside Study Area	0	0	0	0	0	0
PRIVATE & NON-WIS. UNIV.						
In Study Area	1	0	0	1	1	1
Outside Study Area	20	6	32	0	50	6
Subtotal Education Inst.	151	181	146	120	297	301
PROFESSIONAL ASSOCIATIONS	70	12	55	13	111	21
PARENT CO./SAMPLE CO.	47	4	25	3	72	7
MANUF. PRIVATE INDUSTRY	77	10	32	6	109	16
EDUC. PRIVATE INDUSTRY	12	2	9	1	21	3
GOVERNMENT AGENCIES	8	0	8	1	16	1
CONSULTING FIRMS	4	0	3	0	7	0
TRADE JOURNALS	5	0	0	0	5	0
CHAMBERS OF COMMERCE	1	0	4	3	5	3
OTHERS	5	29	0	11	5	40
Subtotal Other Organiz.	229	57	136	38	365	95
TOTAL	380	238	282	158	662	398

Accessibility and Effectiveness of Continuing Education

This section deals with the project objective:

> To determine the accessibility of continuing education opportunities for employed scientists and engineers in the study area.

Accessibility

Only top managers were asked to rate how accessible continuing education opportunities were for the company's employees. Respondents differentiated between technical and non-technical continuing education offerings; however, there was essentially the same reaction to both types of continuing education offerings. About two-thirds of the top managers felt continuing education opportunities were moderately to very accessible. Less than 10 per cent felt these activities were not readily available to them.

TABLE 28

Accessibility of Continuing Education Opportunities According to Top Management

Rating	Technical Opportunities		Non-Technical Opportunities	
	# of Resp.	% of Resp.	# of Resp.	% of Resp.
Very Accessible	29	25	31	27
Moderately Accessible	48	41	48	41
Marginally Accessible	28	24	27	23
Very Inaccessible	9	8	8	7
No Response	2	2	2	2
TOTAL	116	100%	116	100%

Top managers were also asked later in the interview if location of continuing education activities was a problem. Over half of the top managers felt location was not a problem to them; however, the remaining respondents said there was a problem. Even though continuing education opportunities may be fairly accessible, a large number of managers felt there were problems with the location of these activities.

TABLE 29

Location of Continuing Education As a Problem According to Top Management

	# of Responses	% of Responses
Location is Not a Problem	62	54
Location Is a Problem	49	42
Location is a Major Problem	5	4
TOTAL	116	100%

When continuing education was divided by technical and non-technical opportunities, more top managers (43%) indicated the location of non-technical education was more of a problem than technical education (35%). While there was no difference between technical and non-technical accessibility, respondents thought that the location of non-technical programs were more of a problem than technical programs.

TABLE 30

Location As a Problem for Meeting Technical & Non-Technical Continuing Education Needs

	Location Is a Problem		Location Is Not a Problem		TOTAL	
	#	%	#	%	#	%
Non-Technical Continuing Education	50	43	66	57	116	100%
Technical Continuing Education	41	35	75	66	116	100%

More specifically, top managers gave their views on how accessible various providers of continuing education and types of delivery systems were to their company site. The most accessible educational institutions were VTAE institutes and schools, for both technical and non-technical opportunities. Top managers also thought UW System institutions, technical and non-technical programs were readily available. As might be expected, the company itself provided continuing education opportunities, but more along the line of technical courses than non-technical courses.

The accessibility of different types of delivery systems were also discussed with top managers. Some respondents felt technical graduate and undergraduate credit classes were not very available. Even though educational institutions were readily accessible, 16 top managers thought technical credit courses were inaccessible.

TABLE 31

Accessibility of Continuing Education Organizations and Delivery Systems According to Top Management (N=116)

	Number Responding			
	Technical Cont. Educ.		Non-Technical Cont. Educ.	
Organizations	Accessible	Inaccessible	Accessible	Inaccessible
UW System	15	4	16	1
VTAE	29	6	28	1
Private Universities	3	0	2	0
Company Itself	10	1	6	1
Industry	5	0	0	0
Delivery Systems				
Seminar/Conference Workshops	5	1	4	0
Graduate Credit Courses	0	4	3	0
Undergrad. Credit Courses	0	12	0	3
TOTAL	67	28	59	6

Effectiveness

Presidents of companies, top and middle managers were asked to evaluate various types of continuing education programs and activities. Effectiveness questions were presented in the interviews and on questionnaires.

The most effective forms of continuing education in meeting company needs, according to 30 company presidents, were in-service training, seminars and workshops. Formalized education was less effective, i.e., college credit and non-credit courses. Table 32 shows the degree of effectiveness the respondents gave to different forms of continuing education delivery.

TABLE 32

Effectiveness of Continuing Education According to Company Presidents (N=30)

Form	Very effective	Moderately effective	Slightly effective	Not at All effective	No response	TOTAL
	#	#	#	#	#	#
College Credit Courses	5	5	5	10	5	30
College Non-Credit Courses	2	6	4	10	8	30
Seminars	3	17	8	1	1	30
Conferences	4	12	9	2	3	30
Workshops	5	13	7	2	3	30
Self-Study (informal)	5	8	9	3	5	30
Correspondence Courses	0	4	9	8	9	30
In-Service Training	11	12	2	2	3	30

While top managers were not asked explicitly to address a similar question, middle managers were. As true of presidents, middle managers rated in-service training the most effective form of continuing education. This group differed in the next highest order of effectiveness though, middle managers thought informal

self-study should preceed seminars, also college courses were felt to be generally ineffective and correspondence courses were the lease effective.

TABLE 33

Continuing Education Effectiveness According to Middle Management (N=192)

Continuing Education	Very effective		Moderately effective		Slightly effective		Not at All effective		TOTAL Responding	
	#	%	#	%	#	%	#	%	#	%
College Credit Courses	31	16	37	19	21	11	42	22	131	68
College Non-Credit Courses	8	4	37	19	37	19	43	22	125	64
Seminars	41	21	69	36	36	19	12	6	158	82
Conferences	22	11	61	32	50	26	19	10	152	79
Workshops	31	16	50	26	33	17	25	13	139	72
Self-Study (informal)	58	30	73	38	23	12	6	3	160	83
Correspondence Courses	9	5	15	8	35	18	57	30	116	61
In-Service Training	74	39	40	21	18	9	11	6	143	75
Interchange Between Colleagues	55	29	49	26	30	16	16	8	150	79

Furthermore, middle managers evaluated how successful different types of delivery systems were in meeting their objectives for taking classes or participating in continuing education activities during 1976-1978. Table 33A indicates a large number of no responses to these items, but those who did respond support the data above. Once again seminars, conferences and workshops were the most successful, followed by college non-credit courses, college credit courses and organized self-study activities.

TABLE 33A

Successful Experiences With Continuing Education Formats According to Middle Managers (N=192)

Type of Format	Very Successful		Moderately Successful		Marginally Successful		Un-Successful		TOTAL Responding	
	#	%	#	%	#	%	#	%	#	%
College Credit Courses	10	5	7	4	4	2	3	2	24	13
College Non-Credit Courses	10	5	14	7	6	3	3	2	33	17
Seminars, Conferences Workshops	24	12	48	25	15	8	1	1	88	46
Organized Self-Study Activities	5	2	7	4	3	2	2	1	17	9

When continuing education is separated by technical and non-technical subject matter, top managers indicated almost identical levels of effectiveness for both. While about half of the respondents said continuing education was meeting their needs very well to extremely well, almost an equal number felt these needs were not being dealt with very effectively.

TABLE 34

Effectiveness of Continuing Education Meeting Top Management Needs

	Extremely Well Met		Very Well Met		Marginally Met		Poorly Met		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%	#	%
Technical Cont. Educ.	6	5	51	44	38	33	14	12	7	6	116	100%
Non-Technical Cont. Educ.	7	6	51	44	38	33	13	11	7	6	116	100%

The fifty-fifty rating of continuing education rating on effectiveness was further supported by another question dealing with content of continuing education. Top managers indicated their overall concern in Table 35 and their specific concerns in Table 36. There appeared to be more of a problem with technical

education than non-technical education. The main problems were with technical courses in general (other), undergraduate courses and graduate courses. Top managers concerns about college credit courses, especially in the technical areas, reinforces earlier statements made by company presidents and middle managers.

TABLE 35

Content of Continuing Education As a Problem According to Top Management

	# of Responses	% of Responses
Content is Not a Problem	62	54
Content Is a Problem	49	42
Content is a Major Problem	5	4
TOTAL	116	100%

TABLE 36

Level and Content of Education As a Problem for Meeting Continuing Education Needs According to Top Management (N=116)

	Is A Problem		Is Not A Problem		TOTAL	
Technical Content Courses	#	%	#	%	#	%
Graduate	18	15	98	85	116	100%
Undergraduate	22	19	94	81	116	100%
UW-Extension	4	3	112	97	116	100%
VTAE	10	9	106	91	116	100%
Other	27	23	89	77	116	100%
Non-Technical Content Courses						
Graduate	4	3	112	97	116	100%
Undergraduate	-	-	-	-	-	-
UW-Extension	2	2	114	98	116	100%
VTAE	-	-	-	-	-	-
Other	11	10	105	90	116	100%

A further extension of continuing education effectiveness was assessed when top managers were asked what organizations and groups met their educational needs. Top managers agreed with company presidents and middle managers, the most effective programs were technical in-service programs offered by the company itself. VTAE institutions also received a high rating for meeting top managers technical as well as non-technical continuing education needs. The least effective delivery system of continuing education was public and independent colleges and universities. Even though there was not a high response to this question, the outcomes support earlier findings dealing with similar information.

TABLE 37

Organizations & Groups Meeting Continuing Education Needs According to Top Management (N=116)

Organization/Group	Technical Needs				Non-Technical Needs			
	Met		Not Met		Met		Not Met	
	#	%	#	%	#	%	#	%
UW 4-Year System	5	4	5	4	6	5	1	1
UW-Extension	2	2	2	2	3	3	2	2
UW-Center System	2	2	0	0	2	2	0	0
VTAE System	22	19	2	2	23	20	2	2
Independent Univ.	1	1	0	0	0	0	0	0
Professional Assoc.	6	5	0	0	2	2	0	0
Trade Journals	6	5	0	0	0	0	0	0
Company Itself	25	22	9	8	21	18	9	8
Consultants	3	3	0	0	3	3	0	0
Private Industry	11	10	0	0	6	5	0	0

Finally, scheduling of continuing education activities was discussed with top managers. A third of the top managers saw scheduling continuing education activities as a problem. The major scheduling need appeared to be in evening class offerings, and simply finding enough time to pursue continuing education. Few said they wanted weekend classes, and concentrated sessions.

TABLE 38

Scheduling of Continuing Education As a Problem According to Top Management

	# of Responses	% of Responses
Scheduling is Not a Problem	75	65
Scheduling Is a Problem	32	27
Scheduling is a Major Problem	9	8
TOTAL	116	100%

TABLE 39

Scheduling As a Problem for Meeting Continuing Education Needs According to Top Management

	Is A Need		Is Not A Need		TOTAL
	#	%	#	%	#
Weekend Classes	5	4	111	96	116
Evening Classes	23	20	93	80	116
Concentrated Sessions	4	3	112	97	116
No Time is Convenient	15	13	101	87	116

Company Attitudes Towards Continuing Education and Company Policies on Continuing Education

This section responds to the project objective:

> To identify the incentive systems (e.g. promotion, released time, etc.) used by industries to motivate employed scientists and engineers to pursue continuing education opportunities.

In order to understand the policies and procedures companies have adopted to motivate employee involvement in continuing education activities, several questions need to be asked about manager and employee attitudes toward continuing education. Items on the interview instrument and on the company president and scientist and engineer questionnaires dealt with attitudes and employee motivations to participate in continuing education.

In addition, a separate instrument was designed to determine how extensive continuing education activities were being supported by industry. Each corporation president was asked to have an executive familiar with company policies complete a questionnaire specifying reimbursement policies and budget allocations for employees' continuing education participation. All but one of the thirty-one companies responded to the Company Policy questionnaire.

Attitudes

Top manager interviews revealed continuing education's importance to the company does not depend on whether or not the education was technical or non-technical. Table 40 shows no difference in rating technical and non-technical continuing education. Overall ratings indicate top management considered continuing education to be very important to the companies. Few respondents said continuing education was of little or no importance.

TABLE 40

Continuing Education Importance to Company
According to Top Managers

Rating Categories	Technical Cont. Educ. # Responses	Technical Cont. Educ. % Responses	Non-Technical Cont. Educ. # Responses	Non-Technical Cont. Educ. % Responses
Extremely Important	24	21	23	20
Very Important	57	49	59	51
Moderately Important	26	22	25	21
Little or No Importance	9	8	9	8
TOTAL	116	100%	116	100%

The reasons top managers gave for their strong support of continuing education varied, however, there were enough common ideas that four categories could be developed for all responses. The most frequently mentioned (64%) reason was continuing education helped keep employees current with technology. Another large response (29%) category was continuing education's ability to inform the company about consumer, market trends and the changing environment. There were 19 respondents who said continuing education was not important to the company. Table 41 totals are higher than the number of respondents because some people gave several reasons for supporting continuing education.

TABLE 41

Reason for Supporting Continuing Education
According to Top Managers (N=116)

Reasons	# Responses	% Responses
Keep current with technology	74	64
Keep current with market	34	29
Keep competative	22	19
Learn Management Skills	13	11
Other reasons	17	16
TOTAL	160	

Company presidents also stated why it was important for their employees to participate in continuing education activities. There were only three categories which they could respond to on the questionnaire. Presidents felt the most important reason was for employees to perform their present jobs better. Almost equally important, the presidents indicated continuing education would help employees prepare for promotions, salary increases and increase in job responsibilities.

TABLE 42

Reasons for Continuing Education Importance to Employees According to Company Presidents

Reason	Very Important		Moderately Important		Slightly Important		Not at All Important		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%	#	%
To Perform Present Job Better	20	67	10	33	0	0	0	0	0	0	30	100%
For Promotion, Salary & Responsibility Increase	16	54	9	30	3	10	1	3	1	3	30	100%
Personal Development	12	40	16	54	1	3	0	0	1	3	30	100%

Middle managers were asked about the importance of continuing education for themselves. The data in Table XLIII appears to support the company presidents perceptions of the importance of continuing education. Of highest importance were performance of job assignments better, and preparation for increased responsibility. Middle managers disagreed with presidents on the importance of personal development or intellectual stimulation. Interestingly, 40 per cent of the presidents said this was a very important reason for continuing education, while only 28 per cent of the middle managers rated it this high.

TABLE 43

Reasons for Continuing Education Importance
According to Middle Management (N=192)

Reasons	Very Important		Moderately Important		Slightly Important		Not at All Important		TOTAL Respondents
	#	%	#	%	#	%	#	%	#
Perform Present Job Better	116	65	41	23	18	10	4	2	179
Prepare for Increased Responsibility	103	57	50	28	17	9	10	6	180
Attain Enhanced or Authority Position in Own Field	70	39	52	29	31	18	25	14	178
Fulfill Requirements for Promotion	60	34	38	22	33	19	45	25	176
Maintain Present Position in Company	57	32	56	31	40	22	27	15	180
Attain Salary Increase	50	28	45	25	47	27	35	20	177
For Intellectual Stimulation	50	28	63	35	37	21	28	16	178
Prepare for New Job in Current Field	44	25	31	18	56	32	45	25	176
Meet Expectations of Others	37	21	38	21	50	28	53	30	178
Prepare for New Job in Some Other Field	23	13	25	14	47	27	80	46	175
Remedy Deficiencies in Initial Training	16	9	57	34	53	31	44	26	170

Also noteworthy was preparing for a job in some other field was not at all important to middle managers. Evidently when a person changes fields, he uses other methods than continuing education to help prepare him for the job. Not suprisingly, repondents did not feel meeting the expectations of other was an important reason for seeking continuing education.

Incentives

An extension of the questions dealing with reasons for the importance of continuing education to various groups, is the consideration of what motivates people to pursue education. Top managers were asked what they thought would encourage employees to participate in continuing education activities. The motivators mentioned in the interviews were so similar to the categories used for reasons why continuing education was important to middle managers, top managers responses were grouped into the same categories.

In contrast to company presidents and middle managers who said continuing educations highest importance was keeping employees current and helping employees perform their jobs better, top managers most frequently mentioned self satisfaction and personal growth as the primary incentive for employee participation in continuing education. Top managers and middle managers agreed that continuing education is important for helping employees fill requirements for promotion. Similar to middle managers, top managers did not see continuing education as an incentive for preparing an employee for a new job in another field.

TABLE 44

Incentives for Employee Participation in Continuing Education According to Top Management (N=116)

Incentives/Objectives	# Responses	% Responses
Self Satisfaction/Personal Growth	68	59
To Fulfill Requirements for Promotion	42	36
To Attain or Enhance Authority Position in Field	35	30
To Attain Salary Increase	30	26
To Perform Present Job Assignment Better	22	19
To Prepare for a New Job in Current Field	15	13
Reimbursement	12	10
For Intellectual Stimulation	10	9
Encouragement by Company/Peers/Supervisors	8	7
Help Keep Company Competitive	2	2
Personal	2	2
To Prepare for Increased Responsibility	2	2
To Maintain Present Position in the Company	1	1
To Remedy Deficiencies in Initial Training	1	1
To Prepare for a New Job in Other Field	0	0
To Meet Expectations of Others	0	0
TOTAL RESPONSES	250	

Middle managers further refined motivators for different typs of continuing education, including college courses, seminars, and organized self-study. Even though less than half of the people responded to these areas, Table 45 provides some interesting insight on motivation. The most frequently mentioned motivator was the same as noted earlier, to perform present job

better. The type of delivery system best suited for this motivator was seminars, conferences and workshops, although college credit and non-credit courses were good forms also.

The second highest motivator for continuing education was to keep the employee current. Seminars, conferences, workshops and college non-credit courses seem to be the most desirable delivery mechanism for this motivator. The third highest motivator was self-satisfaction and personal growth. It appears any type of delivery system would serve as a good means for providing this experience.

The non-motivators for continuing education, as characterized by the lack of responses, were to maintain present position, prepare for increased responsibility, reimbursement of tuition, and prepare for a new job in current field. Regardless of how continuing education may be delivered, none of these motivators would encourage people to participate.

TABLE 45

Primary Motivators for Continuing Education Activities According to Middle Managers (N=192)

Motivators	College Credit Courses	College Non-Credit Courses	Seminars Conferences Workshops	Organized Self-Study Activities	TOTAL	
	#	#	#	#	#	%
Maintain Present Position	1	0	0	0	1	1
Improve Authority Position	12	1	2	1	16	8
Perform Present Job Better	12	10	23	7	62	32
Prepare for Increased Responsibility	1	0	0	0	1	1
Remedy Deficiencies in Initial Training	2	2	1	2	7	4
To Attain a Salary Increase	1	0	0	0	1	1
To Fulfill Requirements for Promotion	6	3	3	3	15	8
For Intellectual Stimulation	6	5	4	2	17	9
Self Satisfaction/Personal Growth	10	8	6	8	32	17
Reimbursement of Tuition	1	1	0	0	2	1
Encouraged by Company/Peers/ Supervisors	2	4	3	1	10	5
To Help Keep Company Competative	2	3	6	0	22	6
Prepare for Professional Registration	1	0	0	2	1	2
New Topic, Technical	2	4	3	1	10	5
New Topic, Non-Technical	3	0	1	0	4	2
Accessibility/Convenience	8	.8	5	4	25	13
To Keep Current	9	13	17	7	46	24
Reasonable Fees	2	1	2	0	5	3
Applicability to Work	3	3	3	2	11	6
Preapre for New Job in Current Field	0	1	0	1	2	1
No Response	108	125	113	151	-	-

Is there a problem with motivating employees to participate in continuing education? Top managers did not think this was a problem. Only a quarter (27%) felt there was a problem motivating employees to further their education. Furthermore, 78 per cent of the top managers did not view employees lack of motivation to pursue continuing education as a problem. Even if the company did not have a formal continuing education incentive system, these managers felt this would not be a problem to employees who chose to pursue an education.

TABLE 46

Employee Problems Associated With Continuing Education According to Top Management

Employee Problems	# Responding	% Responding
Not a Problem	85	73
Is a Problem	30	26
Is a Major Problem	1	1
TOTAL	116	100%

TABLE 47

Employee Motivation Problems to Seek Continuing Education According to Top Management

Top Management Statements	Seen As Problem		Not Seen As Problem		TOTAL	
	# Resp.	% Resp.	# Resp.	% Resp.	#	%
Employees are not motivated to seek Continuing Education	25	22	91	78	116	100%
Company provides no incentives to employees who seek Continuing Education	6	5	110	95	116	100%

Company Policies

Most (70%) of the sampled companies did not have a formal policy on continuing education. Of those who did, six had a different policy according to personnel classification, i.e., years of service, educational level and organization position.

TABLE 48

Formal Continuing Education Policy
According to Company Presidonts

Company Policy	# of Companies	% Of Companies
Have Formal Policy	9	30
Do Not Have Formal Policy	21	70
TOTAL	30	100%

TABLE 49

Continuing Education Policies Which Differ
By Personnel Classification

Policy Statement	# of Companies	% of Companies
Company Policy Differs by Personnel Classification	6	20
Company Policy Does Not Differ by Personnel Classification	23	77
No Response	1	3
TOTAL	30	100%

What types of incentives, whether formal or informal, do companies offer their employees who participate in continuing education? The policy where a majority (60%) of companies have provided support was recording continuing participation in the employee's personnel file. About a fifth of the companies also reward employee continuing education efforts with pay raises, promotions, time off to complete continuing education, or certificates of completion.

TABLE 50

Types of Incentives, Rewards, or Recognitions
Given to Employees Participating in Continuing Education (N=30)

Type of Incentive	Companies Providing		Companies Not Providing		No Response	
	#	%	#	%	#	%
Pay Raise	6	20	23	77	1	3
Promotion	6	20	23	77	1	3
Certificate Completion	7	23	22	74	1	3
Record of Participation	18	60	11	37	1	3
Bonus	0	0	29	97	1	3
Released Time	7	23	22	74	1	3

Credit Course Policies

Companies seem to financially support employees' continuing education activities regardless of whether or not credits are taken towards a degree. Only two companies have a different policy; however, most companies (60%) do require the employee to successfully complete the course before reimbursement is made.

TABLE 51

Company Policy for Differentiation Between Credits Leading Toward a Degree and Credits Not Leading Toward a Degree

Policy	# Companies	% Companies
Company Does Differentiate in Policy	2	7
Company Does Not Differentiate in Policy	22	73
No Response	6	20
TOTAL	30	100%

TABLE 52

Company Requirements for Successful Completion of Credit Courses

Policy	# Companies	% Companies
Must Complete Course Successfully	18	60
Need Not Complete Courses Successfully	8	27
No Response	4	13
TOTAL	30	100%

To what extent are companies willing to support employees' credit course enrollment? About a third provide total costs of tuition, another third provide partial reimbursement for tuition and a third do not pay for any tuition costs at all. Cost of books and materials are supported to a lesser extent with only 23 per cent paying total expenses, another 23 per cent paying partial costs and 44 per cent not paying anything for books and materials. Travel costs associated with credit course enrollment are only paid by one of the companies. Finally, companies generally do not provide for employee released time from work to pursue credit course instruction. About 20 per cent of the companies allow full or partial pay for released time and 13 per cent require employees to make up time missed from work.

TABLE 53

Company Support of Credit Courses

Type of Support	Not Providing		Total Reimbursement		Partial Reimbursement		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%
Tuition/Fees	10	33	10	33	9	31	1	3	30	100
Books/Materials	13	44	7	23	7	23	3	10	30	100
Travel	25	84	1	3	0	0	4	13	30	100

	Not Providing		At Full Pay		At Partial Pay		To Be Made Up By Employee		No Response		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
Released Time	18	60	1	3	5	17	4	13	2	7	30	100

Non-Credit Course Policies

Independent of credit courses, company officers were asked about the company policy on non-credit courses. About the same number of companies require employees to complete non-credit courses as did those that required credit courses completion.

TABLE 54

Company Requirements for Completion of Non-Credit Courses

Policy	# of Companies	% of Companies
Must Complete Course	19	63
Need Not Complete Course	5	17
No Response	6	20
TOTAL	30	100%

The extent of companies non-credit course financial support were overall slightly higher than for credit instruction for most types of support categories. Non-credit tuition was partially or fully reimbursed by over two-thirds of the companies, books by 50 per cent, and travel by 13 per cent. Employee released time from job to pursue continuing education was supported by one more company for credit courses than non-credit courses, i.e., six supported the former while five supported the later.

TABLE 55

Company Support of Non-Credit Courses

Type of Support	Not Provided		Total Reimbursement		Partial Reimbursement		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%
Tuition/ Fees	5	16	11	38	9	30	5	16	30	100
Books/ Materials	9	30	8	27	7	23	6	20	30	100
Travel	20	67	3	10	1	3	6	20	30	100

	Not Provided		At Full Pay		At Partial Pay		To Be Made Up By Employee		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%	#	%
Released Time	14	48	0	0	5	16	5	16	6	20	30	100

Workshops, Seminars & Conferences Policies

Because non-credit courses may be different from short specialized workshops, seminars and conferences, a separate inquiry was made about company policies on these types of continuing education delivery. In contrast to credit or non-credit courses, companies strongly support workshops, seminars, and conferences. From 80 per cent to 90 per cent of all costs associated with continuing education were totally paid for by the companies.

TABLE 56

Company Policy Support of Workshops, Seminars & Conferences

Type of Support	Not Provided		Total Reimbursement		Partial Reimbursement		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%
Tuition/Fees	1	3	27	90	0	0	2	7	30	100
Books/Materials	1	3	26	87	1	3	2	7	30	100
Travel	4	13	24	80	0	0	2	7	30	100

Organized Self-Study Policies

The last type of continuing education instruction is organized self-study. This includes programmed texts and correspondence courses where the entire responsibility of self education is placed on the employee in an unstructured setting. Organized self-study completion was required by about half the companies which was less than the requirement for credit or non-credit courses.

TABLE 57

Company Requirements for Completion of Self-Study Type Courses

Policy	# of Companies	% of Companies
Must Complete Course	14	47
Need Not Complete Course	9	30
No Response	7	23
TOTAL	30	100%

The extent of company support for tuition and fees of self-study education was the lowest (57%) of the four types dealt with in this study. Reimbursement for books and materials was to about the same extent (50%) as for credit and non-credit courses.

TABLE 58

Company Support of Organized Self Study, Programmed Texts and Correspondence Courses

Type of Support	Not Provided		Total Reimbursement		Partial Reimbursement		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%
Tuition/Fees	11	37	11	37	6	20	2	6	30	100
Books/Materials	11	37	10	33	6	20	3	10	30	100

Sources of Funding

The company officer completing the continuing education policy questionnaires were asked to specify where they charged the costs for reimbursing employees participating in certain continuing education activities. About half of the companies paid for these expenses out of the employee's department/group unit. Another 17 per cent said they had a general education fund to support such activities. A large percentage (30%) of the companies did not respond to three out of four categories which would indicate no special accounts were established for continuing education activities. However, for seminars, conferences and workshops the majority of companies charged departments for educational expenses.

TABLE 59

Company Budgeting of Continuing Education Activities

Type of Continuing Education Activity	Direct Expense of Employee's Dept/Group/Unit		General Ed. Fund		Both Direct Expense & Gen. Fund		Other		No Response		TOTAL	
	#	%	#	%	#	%	#	%	#	%	#	%
Credit Courses	14	47	5	17	1	3	1	3	9	30	30	100
Non-Credit Courses	14	47	5	17	1	3	1	3	9	30	30	100
Seminars, Conferences & Workshops	18	60	5	17	1	3	2	7	4	13	30	100
Organized Self-Study	14	47	2	7	1	3	2	7	11	36	30	100

In addition to learning where companies charged their costs for employees' continuing education participation, they were asked to estimate their tuition reimbursement and other expenditures for continuing education (1976-1978) and their future expenditures (1979-1981). These dollar amounts did not include salaries and expenses for in-house continuing education, or for training staff

or expenditures for capital equipment. Since only two-thirds of the companies responded to these questions, interpretation of the results may be limited. Also median and mean statistics were computed because the latter is sensitive to extremes, e.g., zeros and high frequencies. Therefore, the median may be a truer reflection of company continuing education expenditures.

The median annual amount expended on continuing education (tuition and books, materials and travel costs) significantly increased from $900 to $1450 during 1976-1978. Companies average expenditure for tuition doubled, and other continuing education expenses increased 30 per cent over this same period. There was a wide disparity among companies in their support of continuing education, i.e. some reported no expenditures while one company spent of $60,000 a year. Appendices D-1 and D-2 provide a distribution of tuition and other types of expenditures of 1976-1978.

TABLE 60

Average Company Expenditures for Continuing Education 1976-1978

Average Measures	Tuition Expenditures			Other Types of Expenditures		
	1976	1977	1978	1976	1977	1978
Median	$ 400	$ 500	$ 800	$ 500	$ 850	$ 650
Mean	$1580	$2138	$5268	$2084	$2663	$3242
No. of Companies Responding	20	21	22	19	19	19

The estimates for overall continuing education expenditures (tuition and other expenses) for 1979-81 showed a median increase of 18 per cent. This was a lower rate than might be expected, however, this may be due to several companies not projecting future continuing education expenditures. Appendix D-3 has a distribution of estimated allocations for continuing education for 1979-1981.

TABLE 61

Average Company Allocations for Continuing Education 1979-1981

Average Measures	1979	1980	1981
Median	$2,165	$2,250	$2,333
Mean	$7,526	$8,518	$9,206
No. of Companies Responding	19	17	17

Monetary Support

Top managers (85%) felt the support of continuing education was not a problem. The cost of continuing education and the company's return on its investment were also seen positively by top managers. Therefore, it did not appear finances were a limitation to continuing education involvement, and managers felt they got a return on their investment.

TABLE 62

Monetary Problems Associated With Continuing Education According to Top Management

Employees Problems	Number	Per Cent
Money is Not a Problem	99	85
Money Is a Problem	14	12
Money is a Major Problem	3	3
TOTAL	116	100%

TABLE 63

Cost of Continuing Education and Return on Investment According to Top Management

Top Management Statements	Seen as Problem		Not Seen as Problem	
	#	%	#	%
Cost of Continuing Education	10	9	106	91
Return on Investment	4	3	112	97

Non-Company Supported Continuing Education

Middle managers were asked if they participated in any continuing education (in 1978) that was not supported by their company, i.e., activities the company did not sponsor, or for which the employee did not receive support for participation. Only 17 per cent of the respondents indicated they pursued education at their own e nse. This would lead one to conclude that employers need to support continuing education in order for employees to participate.

TABLE 64

Continuing Education Participation by Middle Managers When Not Supported by Company

	# of Responses	% of Responses
Participants	32	17
Non-Participants	160	83
TOTAL	192	100%

Of the 32 respondents pursuing continuing education at their own expense, most (59%) participated in activities outside formal educational institutions, i.e., professional societies and independent educational organizations and businesses.

TABLE 65

Where Middle Managers Received Their Continuing Education When Not Supported by Company

Organization	# of Responses	% of Responses
College or University	6	19
Professional Society	11	34
Independent Educational Organization or Businesses Providing Educational Services	8	25
Technical Schools	7	22
TOTAl	32	100%

Corporations Capital Expenditures Supporting Continuing Education

This section responds to the project objective:

> To investigate the educational materials, facilities and equipment used by industry to support continuing education programs for employed scientists and engineers.

Company personnel officers were asked to assess the status of their companies educational delivery equipment and educational materials. Most companies (83%) did not have equipment for internal use. The types of delivery equipment owned by companies are shown in Table 66.

TABLE 66

Companies Educational Equipment

Type of Equipment	# of Responses	% of Responses
Movie Projector	5	17
Slide Projector	4	13
Overhead Projector	4	13
Video Projector	3	10
Slide Projector with Audio	1	3
Product Models	1	3
Tape Recorder/Phonograph	2	7
Cameras/Lenses	1	3
TOTAL	21	

The dollar amount allocated in 1978 to purchase, replace and maintain this equipment ranged from zero to over $1,000. The number of companies budgeting for these expenses and the dollars allocated are shown in Table 67. The mean expenditure for delivery equipment was about $300 a year.

TABLE 67

Amount Allocated for Purchase, Replacement and Maintenance of Delivery Equipment

$ Amount	# of Companies	% Responding
0	7	23
200	1	3
500	2	7
700	1	3
1000	2	7
No Response	17	57
TOTAL	30	100%

Company owned educational materials was similarly small. About 75 per cent of the companies did not have articles, books, pamphlets, cassetts and other materials for employee use. Table 68 lists the type of materials they had available in 1978.

TABLE 68

Educational Materials Presently Held by Company

Type of Materials	# of Responses	% Responding
Books/Manuals/Library	8	27
Trade Magazines	5	17
Schematic Pictures	1	3
Product Line Brochures	1	3
Standard Specifications	1	3
Government Publications	1	3
TOTAL	17	

The amount of 1978 dollars allocated to the purchase and replacement of educational materials is shown in Table 69. Even though the average educational materials expenditure of $684 is more than twice that of equipment ($300), it seems small in comparison to company annual dollar commitments to their employees' continuing education.

TABLE 69

Amount Allocated to Purchase & Replacement of Educational Materials

$ Amount	# of Companies	% Responding
0	5	17
50	1	3
150	1	3
500	2	7
700	1	3
1500	1	3
2000	1	3
3500	1	3
No Response	17	57
TOTAL	30	100%

CHAPTER IV

Observations and Conclusions

To assess the continuing education needs of scientists and engineers employed in small geographically dispersed industries, thirty companies in central and northern Wisconsin were visited during 1978-79. The respondents in the study consisted of 30 company presidents or their representatives, 116 top managers and 192 middle managers. Demographic data on these groups supported each individual's level of responsibility within the company. The formal education of middle managers, i.e., those principally responsible for scientific and engineering departments and operations, was predominately at the post-secondary level with 45% having completed a bachelor's or higher degree. It was agreed early in the study personnel who had responsibilities for science and engineering would be eligible for the interview and questionnaire regardless of education attainment. The data indicates most middle managers earned their supervisory position through on-the-job-training and continuing education. Chief executive officers of many of the companies interviewed also said their firms could not afford to pay degreed engineers and the individuals performing engineering type jobs were more than satisfactory.

The principle type of work scientists and engineers are engaged in was mechanical engineering, design, and industrial engineering. It was also noted that almost a fifth of these technical people were performing research and development tasks which may be unexpected in small firms. Another interesting fact was over 40% of the scientists and engineers have been in their technical positions less than ten years. This may indicate a large turn-over and replacement in the field or small companies are expanding into new fields which require more technical people. The study did not investigate this issue but it may mean more continuing education opportunities need to be made available to keep personnel current in their fields.

There are a wide array of educational opportunities for scientists and engineers. Much of the education is gained through individual initiative and informal means. Over three-fourths of middle managers said they regularly read professional and trade journals. Another effective means of keeping current in the field, regardless of discipline, is frequent contact with one's colleagues. Most scientists and engineers did this on a regular basis. The informal exchange of information is crucial in all fields and small companies are no exception. In fact, because they do not have large research and development staffs, these size companies located away from large population centers, probably rely quite heavily on these forms of communication.

One of the most frequently used forms of continuing education in small industries was in-service training programs offered by the company itself and at the plant itself. The programs were almost entirely informal (OJT) in format and technical in content. This should not be surprising since small industries tend to be principally involved in producing a final product and, therefore, require employees to learn new ways to improve the production.

In addition to in-service programs, industrial personnel made a great deal of use of continuing education offered by manufacturers of equipment used by the company and professional and trade associations. Of the 29 contacted professional and trade associations in the sciences and engineering, 178 programs were offered during 1976-78. About 60% were technical courses. Participation in continuing education provided by educational institutions was less than half that delivered by non-educational institutions. This may indicate the continuing education needs of small industry are so specific to their task that educational institutions cannot deliver what is needed. Many corporation heads implied that this was the case but did not express a lack of confidence in post-secondary education in this regard.

There are extensive continuing education opportunities for scientists and engineers in Wisconsin's post-secondary institutions. The University of Wisconsin System, consisting of 13 four-year campuses, currently offers 170 degrees in the applied sciences and engineering. The University of Wisconsin Center System's 14 two-yearcampuses provides a cross section of general education courses and associate degrees in the sciences. The Vocational, Technical and Adult Education System has 38 campuses which offer a total of 344 diplomas and associate degrees in trade and industry. The 21 independent Wisconsin colleges and universities have 102 applied science and engineering programs. Finally, University of Wisconsin Extension's department of applied science and engineering has delivered some 184 courses, mostly non-credit, in central and northern Wisconsin during 1976-80. It appears from these data there would be ample opportunities for employed scientists and engineers to continue their education.

However, the location of the institutions are not necessarily convenient for clients to be served. A preliminary analysis of the number of industrial firms in Wisconsin, regardless of size, showed 48% were located in central and northern Wisconsin. The proportion of science and engineering programs available in central and northern Wisconsin were: UW System 4-year campuses 25%, VTAE System 2-year campuses 58%, and Wisconsin independent colleges and universities 36%. While these

comparisons do not take into account the employment size of various industries, there appears to be an under-representation of science and engineering programs in upper Wisconsin in comparison to the southern part of the state.

Industrial executives and scientists and engineers did not say they were disappointed with the access to continuing education. Most respondents thought opportunities for continuing education were accessible but the location of these activities were seen as a problem by many people. Non-technical education was considered more of a concern than technical education. The most accessible institutions were the VTAE institutes and UW institutions where also convenient but credit course instruction was judged as being rather inaccessible. There are more VTAE institutions in central and northern Wisconsin than there are 4-year colleges. Company officials again indicated they would like more undergraduate and graduate courses available in their region.

When managers were asked what organizations should provide continuing education in the future, a significant majority felt post-secondary institutions should take on more of this responsibility. The most frequently preferred institutions to deliver continuing education were the University of Wisconsin (4-year) System and the VTAE (2-year) System. This need was most pronounced in geographical areas close to the industries themselves rather than at distances which make it impractical to commute on a frequent basis. These outcomes are not too surprising since it would be less expensive to have employees attend a regional educational institution than to pay consultants to come to the plant, or spend valuable company time to continually train personnel or send employees to professional conferences for extended periods of time.

Over 400 subjects were suggested for future offering and most of these were technical. However, respondents wanted more personal development and business administration courses available. In light of the previous discussion, higher educational institutions could meet more of the technical subject need but especially the non-technical areas could be offered to a greater extent. This latter demand seems particularly appropriate at this time because institutions could possibly handle much of the increase in personal development courses within existing resources. Whereas with technical subjects a significant requirement for faculty expertise and capital equipment might not be feasible. Most of the companies interviewed did and could train their employees in basic technical areas but they do not have and cannot afford to employ experts in the human services areas.

In further support of increased interest in post-secondary education was the desire to have more college credit and non-credit courses. While seminar, conference or workshop formats are still the most popular way to deliver continuing education, a large number of managers wanted the traditional college courses expanded. The implication here is similar to statements made earlier, i.e., industry would prefer colleges to take a larger share of the continuing education.

Not surprisingly respondents felt in-service training courses were the most effective while correspondence courses were the least effective. rs, conferences and workshops were also rated high on effectiveness while ge credit courses were not. Scheduling these activities does not seem to be much of a problem although some respondents suggested more evening classes are needed. Again, industry personnel prefer the informal and direct "hands-on" experience over more formalized classroom structure or the totally unstructured experience of self-study. What the respondents appear to be saying is make continuing education more meaningful to their day to day lives in an informal instructional setting and provide these experiences at educational institutions more often or bring faculty to their plants to teach them special skills and personal development.

Continuing education, regardless of where it is taught, how it is taught, and who teaches it, industry feels, is very important. The main reason for this support is because managers see continuing education as a means for keeping their employees current in technology and up-to-date on trends in the market place. Also, employees felt continuing education was important but for different reasons, i.e., to perform their jobs better and to prepare them for increased responsibility. Interestingly personal development and intellectual stimulation were considered important continuing education outcomes by top managers but employees did not rate these attributes very high. These reasons were similar as incentives for participation in continuing education activity. Also, any type of delivery system is a movitator, although as stated before, seminars, conference and workshops appeal to employees the most. Therefore, continuing education is a valuable experience for all industrial personnel, i.e., for those who manage others as well as those who are managed.

Company managers, furthermore, do not view motivation as a problem for employee participation in continuing education regardless of whether or not the company has a reward system for such activity. Most of the small industries do not have a formal continuing education policy. Their means of rewarding employee continuing education involvement is primarily through recording it in the personnel files. Few companies give employees pay raises, promotions and time off to complete continuing education.

Many of the key managers interviewed said they rewarded continuing education on an individual basis, i.e., taking many factors into consideration. The employees who are likely to gain the most from participation are encouraged while others are not.

When it came to reimbursing employee expenses for continuing education, company priorities were: (1) seminars, conferences and workshops where almost all expenses were paid, (2) non-credit instruction where most but not all expenses were paid, (3) credit courses were paid about at the same level as non-credit instruction and, (4) organized self-study, e.g., correspondence courses, only partial financial support was given to the employee. These graduated levels of support reflect much of the earlier data on continuing education interest, effectiveness, etc. Companies are willing to pay for employee growth and development when they are convinced their dollars are well spent.

The average annual expenditure for company employee continuing education activities increased from $900 to $2,333 over the period of the study 1976-80. Managers thought on the whole continuing education was a worthwhile investment. However, when companies did not reimburse employees for continuing education expenses, few participated at their own expense. This observation leads one to conclude that to increase employee involvement in continuing education, companies will need to financially back these activities.

Small industries tended not to own permanent property to deliver continuing education in their own plants. On the average they spent $300 a year on equipment and about $700 a year on educational materials. If companies are expecting educational institutions to take a greater role in delivery of continuing education then expansion of special equipment and materials may not be necessary. However, if satisfaction is not reached through external groups and institutions, industry itself will have to invest in personnel and capital equipment and materials to get the job done.

The message is clear from these representative small industries in central and northern Wisconsin. They believe in continuing education and judge it to be important to their companies and they would like to have post-secondary educational institutions provide more of it at locations close to where they live and work. What may appear to be an inconsistency in industries' lack of interest in credit classes and their desire to have more college instruction is a matter of delivery of continuing education. It was a high priority among respondents that there be available more technical and non-technical college instruction but in formats of workshops, conferences and seminars.

APPENDIX A-1

Sample Small Industries Organized by JACCE Regional Areas

Final Participants	(X)	Firms	SIC*	Product	Company Size	City
North West						
1.		T.O. Plastics	3079	Bedding Plant Containers	32	Hudson
2.	X	Murphy Oil Corporation	2911	Distilate & Residual Fuel	155	Superior
3.		Birchwood Manufacturing	2435	Laminated Wood	235	Rice Lake
4.		Tester Corporation	3553	Portable Bandsaws	35	Iron River
5.	X	Vollrath Regrigeration	3585	Refrigeration	190	River Falls
North Central						
6.	X	Hammer Blow Corporation	3714	Axle Suspensions	100	Wausau
7.	X	Stevens Point Beverage	2082	Beer Brewery	34	Stevens Point
8.		Marshfield News-Herald	2711	Daily Newspaper	70	Marshfield
9.	X	Monarch Paper	2099	Dried Yeast	45	Rhinelander
10.		Fisher Scientific Co.	2831	Educational Biologicals	15	Clear Lake
11.		Nortech, Inc.	3537	Handling Equipment	60	Antigo
12.	X	Jarp Corporation	3599	Hydraulic Cylinders	60	Schofield
13.	X	North Central Machine & Tool	3599	Production Machining	30	Wausau
14.		Merrill Manufacturing	3315	Wire Products	200	Merrill
Western						
15.	X	Durand Canning Company	2033	Canned Products	120	Durand
16.		Greenwood Milk Products	2022	Cheese Production	40	Greenwood

* Standard Industrial Classification Index (SIC)

Final Participants	(X)	Firms	SIC*	Product	Company Size	City
Western Cont.						
17.		Dadco Food Products	2038	Frozen Pizza	300	Black River Falls
18.	X	Badger Iron Works	3321	Iron Casting	45	Menomonie
19.	X	Consolidated Thermoplastics	3079	Plastic Films	104	Chippewa Falls
20.	X	Vacuum Platers	3471	Plating Metal Parts	54	Mauston
21.		La Crosse Printing	2752	Process Lithography	55	La Crosse
22.		La Cro Products	3679	Production of Wire Harnesses	55	La Crosse
23.	X	Northwestern Motor Co.	3537	Towing	65	Eau Claire
North East						
24.	X	Overly Incorporated	3555	Airfoil Dryers	100	Neenah
25.	X	Gilbert Paper Company	2621	Bond Paper	355	Menasha
26.	X	Sargento Cheese Co.	2022	Cheese Packaging	280	Plymouth
27.		Better-Brite Plating	3471	Chrome Plating	45	De Pere
28.		Diamond Printing	2751	Commercial Printing	40	Sheboygan
29.		Badger Printing Corp.	2752	Commercial Print.	55	Appleton
30.		Kieckhefer Boxes	2657	Corrugated Boxes	50	Wild Rose
31.		Fanetti Stone	3281	Crushed Stone	14	Fond du Lac
32.	X	Marathon Engineering	8911	Engineer Consultants	68	Menasha
33.	X	Wald Wire	3496	Fabricated Wire	27	Oshkosh
34.	X	Fox River Boiler Works	3443	Fabrication of Steel	25	Appleton
35.	X	Chilton Metal Products	3079	Gas Tanks	365	Chilton
36.	X	Perfex Energy Systems	3443	Heat Transfer Products	180	Berlin
37.		Lube Devices	3569	Hydraulic Components	55	Manitowoc

Final Participants		Firms	SIC	Product	Company Size	City
North East Cont.						
38	X	C.A. Lawton Company	2448	Hydraulic Presses	105	De Pere
39.		Lunde Metal Fabricating	3443	Ice Machines	25	Oconto
40.	X	Foremost Foods	2033	Lactose	475	Appleton
41.	X	Mill-Craft Housing Corp.	2452	Modular Homes	240	Waupaca
42.	X	Hoffmaster Compnay	2647	Napkins	300	Oshksoh
43.	X	Geddings and Lewis Electronics	3622	Numerical Controls	120	Fond du Lac
44.	X	Renard Machine Company	3554	Paper Cutters	50	Green Bay
45.		Badger Paper Mills	2621	Paper Production	440	Peshtigo
46.	X	Safeguard Automotive	3592	Piston Casting	357	Marinette
47.	X	Formrite Rube	3498	Prefabricated Tube	175	Two Rivers
	X	Response Graphics	2761	Printing Books	461	Green Bay
49.	X	Natural Casing Company	2013	Sausage Casing	65	Peshtigo
50.		Reimer Meat Products	2013	Sausage	92	Green Bay
51.	X	Plastics Engineering	2821	Synthetic Resins	450	Sheboygan

APPENDIX A-2

Sample Companies Choosing NOT to Participate in Study

Firm	Reason NOT to Participate
1. Reimer Meat	New Management; no S/E employed
2. Better-Brite Plating	Unable to reach President
3. Fisher Scientific Company	Only one biologist
4. La Cro Products	Too busy
5. Diamond Printing	Company does strictly printing; no S/E employed
6. Panetti Stone	New Management; no S/E employed
7. Lube Devices	Unable to reach President
8. Badger Printing	Company does strictly printing; no S/E employed
9. La Crosse Printing	Company does strictly printing; no S/E employed
10. Marshfield News-Herald	Newspaper business; no S/E employed
11. Birchwood Manufacturing	Only one engineer. Study inappropriate
12. Greenwood Milk Products	A milk cooperative; study not appropriate
13. Lunde Metal Fabrication	Unable to reach President
14. T.O. Plastics	No S/E at local plant; only maintenance personnel
15. Tester Corporation	No S/E employees; only tool & dye personnel
16. Dadco Food Products	Not interested in study
17. Nortech, Inc.	Unable to reach President
18. Kieckhefer Boxes	Unable to reach President
19. Merrill Manufacturing	Unable to decide who should be interviewed
20. Badger Paper Mills	Too busy

APPENDIX A-3

Definitions and Terms Agreed to at NSF Project Directors, Meeting
November 21, 1978

I. Definitions to Parameters

A. Continuing Education

1. Defined as education or training which increases the individual's scientific or engineering competence and/or academic study toward an advanced degree.

2. Upgrading and updating continuing education activities are to be analyzed separately. The former refers to changing one's status with an advanced degree while the latter implies improving one's knowledge to keep current in the field.

3. Credit and non-credit courses are to be studied separately.

4. Technical courses involving engineering and scientific subjects and non-technical courses which include management and/or personal development should be studied separately.

B. Scientists and Engineers

1. Defined as employees who hold at least a Bachelor's degree (or the equivalent, i.e. state issued license to practice in scientific or engineering field) in an engineering and/or scientific field and/or spend more than half of their time in the following job functions:

research	maintenance
development	planning
testing & evaluation	contract & grant administration
design	data collection
construction	providing or researching of scientific or technical information
inspection	
production	
installation	enforcement of standards or regulations
operation	

2. In addition, but separately analyzed, are scientists and engineers who spend more than half their time in management, sales, advertising, personnel work, teaching and training, or providing medical, psychological, or social services.

3. Technologists and/or technicians may be included in study but analyzed separately.

C. Small Industry

1. Industries or plants with fewer than 500 total personnel would be included in the study. No lower limit was specified.

2. Plants which are a subsidiary of large companies but which have fewer than 500 total personnel at the particular site will be included under the definition of small industry.

3. Consulting firms (e.g., civil engineering, etc.) will be included under the definition of small industry.

D. Geographically Dispersed Industry

1. Defined as: Plants/companies which are located in non SMSA counties which do not have a college or university offering a graduate degree in science or engineering.

2. Scientific/engineering employees of local government (city, township, county) could be included only in those studies which originally proposed to do so. These studies should report their data separately.

E. Continuing Education Delivery Systems

1. It was agreed that questions regarding delivery systems used for continuing education should have a time period limitation of those used within the last three years.

2. Delivery system questions should be asked of both employers and employees.

3. Delivery system questions should be asked to obtain data on both the "actual" delivery system being used and on the "desired" delivery system.

II. Project Activities

A. At a minimum Data Collection Categories will include the following:

1. Technical contents of Continuing Education programs

2. Incentives (motivation) for participation in C. E. programs by employers/employees.

3. Personal characteristics

- Highest degree
- Field of work
- Number of years in field
- Age (range)
- Years since last degree
- Certification and/or licenses
- Professional organization membership (national, state, local)
- Extent to which prerequisites for graduate level courses have been obtained.

4. Type of Continuing Education delivery system used in last three years by employer/employee to include both actual and desired C. E. delivery system.

5. Importance of Continuing Education.

6. Perception of the individual's degree of obsolescence.

7. Unmet C. E. needs and indicators of C. E. needs.

8. C. E. time spent per month.

9. Source of funds for Continuing Education.

APPENDIX A-4

"Graduate Student Interview Workshop"

INTERVIEWER PREPARATION

SESSION I

A. Review and discuss resume and individual background of interviewers

B. Individual preparation

1. Thorough knowledge of information needed for study
2. Research the company
3. Know place and time of interview along with name and title of interviewee. Get there early!
4. Dress in good taste - neat, well-groomed
5. Act pleasant, courteous but mature - business-like, confident manner
6. Do not smoke or chew gum

C. Review questionnaire and individual questions thoroughly

D. Review all preparatory material in detail

SESSION II

1. You should control and direct the interview but not offensively. Handle it crisply.

2. Be a wide-awake, intelligent listener - pay attention but ask for clarification immediately if you have a question. Be thorough and pursue.

3. Look at the person. Direct questions to the individual - not to the ceiling or the window.

4. Be relaxed - don't betray nervousness! You won't be nervous if you work from complete and thorough knowledge of the information you need and your instrument.

5. Keep cool and calm - don't over-react. Maintain an objective approach.

6. Know precisely which areas to explore and exactly what to look for.

7. Use open-ended questions to get elaboration.

8. Use closed questions to get specifics - but not just "yes" and "no" answers.

9. Ask for clarification immediately if a question remains in your mind.

10. Let the person do the talking but you maintain direction.

11. Record answers during the interview. Don't try to reconstruct from memory. It doesn't work!

12. Get all the facts or information.

13. You terminate the interview.

14. Thank them for their time.

15. Follow-up "thank you" letter.

16. Be sure to keep interview to allotted time (1-1½ hours).

INTERVIEWER PREPARATION

SESSION III

A. Roleplay interview

1. V.P. Engineering

Johnson Plastics Machinery
Chippewa Falls, Wis.

2. President/Chairman of the Board/Treasurer

Magna-Graphics Corp.
Oconto Falls, Wis.

3. Chief Plant Engineer

Green Bay Food Co.
Green Bay, Wis.

B. Critique of each interview by all

APPENDIX A-5

Company Assessment Instruments

INTERVIEW INSTRUMENT

_____

_____

1. What programs does _____have in continuing education? (In house)

2. How important is continuing education to this company

Extremely important	( )
Very important	( )
Moderately important	( )
Little or no importance	( )

3. How well are _____needs for continuing education being met?

Extremely well ( )

Very well ( )

Marginally ( )

Poorly ( )

4. How would you rate the accessibility of continuing education opportunities available to your people?

Very accessible ( )

Moderately accessible ( )

Marginally accessible ( )

Very inaccesible ( )

Why did you give this rating?

5. What incentive(s) in particular motivate your people to participate in continuing education?

6. What problems do you experience with continuing education?

Location of Continuing Education

Content of Continuing Education

Scheduling

Monetary

Employee

Other

7. In what types of educational activities do your people participate?

Activities	Who offers the CE	Content of CE
workshops, seminars, conferences, course work-technical -college self-study, in-service	colleges VTAE professional associations other industries	technical non-technical

8. Which groups have provided the education activities your people need?

9. What areas would you like to see offered in the future?

Activities	Who should offer CE	Content of CE
Workshops, conferences seminars, course work, self-study	Colleges VTAE professional associations other industries	technical non-technical

10. Any other comments?

COMPANY POLICY QUESTIONNAIRE

1. What type of incentives, rewards, or recognitions are given to employees who participate in continuing education activites? Check (✓) all blanks that apply.

(a) pay raise . . . . . _____
(b) promotion . . . . . _____
(c) certificates of completion . . . . . _____
(d) record of continuing education participation placed in individual's personnel file . . . . _____
(e) bonus . . . . . _____
(f) time off to complete continuing education . . . . _____
(g) other (specify)_____ _____

_____

2. Does your company policy differ according to personnel classification (i.e., years of service, educational level, organizational position)?

Yes _____ No _____

If yes, please explain.

_____

_____

_____

3. To what extent does the company provide support for college credit courses? Check (✓) one in each row.

	Not Provided	Partial Reimbursement	Total Reimbursement
(a) Cost of tuition and registration	_____	_____	_____
(b) Cost of books and instructional materials	_____	_____	_____
(c) Travel costs	_____	_____	_____

	Not Provided	Partial Reimbursement	Total Reimbursement	To be made up by employee
(d) Release time from job	_____	_____	_____	_____

(e) Does your company require employee to successfully complete course?

Yes _____ No _____

4. Does your company policy differentiate between credit leading toward a degree and to credit not leading toward a degree?

Yes _____ No _____

If yes, please explain.

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. For non-credit courses, to what extent do you provide the following types of support? Check (✓) one blank in each row.

	Not Provided	Partial Reimbursement	Total Reimbursement
(a) Cost of tuition and registration	_____	_____	_____
(b) Cost of books and instructional materials	_____	_____	_____
(c) Travel costs	_____	_____	_____

	Not Provided	At Partial Reimbursement	At Full Reimbursement	To Be Made Up By Employee
(d) Release time from job	_____	_____	_____	_____

(e) Does your company require employee to successfully complete course?

Yes _____ No_____

6. To what extent do you provide the following types of support for workshops, seminars, and conferences? Check (✓) one blank in each row.

	Not Provided	Partial Reimbursement	Total Reimbursement
(a) Cost of tuition and registration	_____	_____	_____
(b) Cost of books and instructional materials	_____	_____	_____
(c) Travel costs	_____	_____	_____

7. To what extent do you provide the following types of support for organized self study, programmed texts, and correspondence courses? Check (✓) one blank in each row.

	Not Provided	Partial Reimbursement	Total Reimbursement
(a) Cost of tuition and registration	_____	_____	_____
(b) Cost of books and instructional materials	_____	_____	_____

(c) Does your company require employee to successfully complete course?

Yes _____ No _____

8. Estimate your overall annual expenditure for continuing education during calendar or fiscal year 1976, 1977, 1978. Do not include salaries and expenses for your in-house continuing education or training staff. Do not include expenditures for capital equipment.

	1976	1977	1978
(a) For tuition reimbursement programs	$_____	$_____	$_____
(b) For all other activities	$_____	$_____	$_____

(c) What future annual expenditures do you anticipate for C. E. activities?

For 1979 $_____, 1980 $_____, 1981 $_____.

9. For each of the continuing educational activities listed below, please indicate the source of funds. Check (✓) all blanks that apply.

Activities	SOURCE OF FUNDS: Direct Expense of Employee's Dept/Group/Unit	SOURCE OF FUNDS: General Educational Fund	SOURCE OF FUNDS: Other (Specify)
(a) Credit courses			
(b) Non-credit courses			
(c) Seminar/conferences/ workshops			
(d) Self study/programmed texts/ correspondence courses			
(e) Other (specify)			
_____			
_____			
_____			

10. What type of educational delivery equipment does your company have available?

    a. List types of each kind of equipment and net worth.

	Equipment	Condition	Number	$
(1)				
(2)				
(3)				

    b. How much was allocated to the purchase of replacement of new equipment and maintenance of existing equipment in 1978? $_____

11. What educational materials are presently held by your company?

    a. List articles, books, pamphlets, cassettes, etc. and net worth.

	Ed. Material Type	Year Purchased	Number of Materials	$
(1)				
(2)				
(3)				

    b. How much was allocated to the purchase and replacement of educational materials in 1978? $_____

SCIENTISTS/ENGINEERS, TECHNICIANS
AND TECHNOLOGISTS QUESTIONNAIRE

1. What is the highest engineering or scientific degree you hold? . . . . _____

   (1) High school diploma
   (2) Associate or technical degree
   (3) Bachelor's degree
   (4) Master's degree
   (5) Ph.D./Ed.D./M.D.
   (6) Other (specify:_____)

2. For how many years have you been employed as a scientist or engineer, technician or technologist? . . . . . _____

3. Which one category best describes your highest current level of supervisory responsibility? . . . . . _____

   (1) No supervisory responsibility
   (2) Supervision of technicians and/or nontechnical personnel
   (3) Supervision of engineering and/or scientific personnel
   (4) Management of supervisory personnel
   (5) Executive (upper management)

4. Which one category best describes your highest current level of technical responsibility? . . . . . _____

   (1) Perform limited assignments with specific direction under an experienced engineer or scientist
   (2) Perform assignments with limited directions, with a general review of work done.
   (3) Independently perform most work with directions only to general results expected.
   (4) Independently work in extending known techniques, data, etc.
   (5) Technical direction and review of work performed by others
   (6) Other (specify)_____

5. How many engineering or scientific journals or periodicals in your field do you regularly read? . . . . . _____

   (1) Don't regularly read any
   (2) Read one regularly
   (3) Read two regularly
   (4) Read three or more regularly

6. With how many colleagues in other organizations do you exchange scientific or engineering information on a regular basis? . . . . . _____

   (1) None
   (2) One to three
   (3) Four or more

7. How often, during the normal performance of your job, do you encounter an unusual technological problem, (i.e., a problem which you can't solve readily because it is an unfamiliar one)?

(Please check one)

( ) less than once per year
( ) 1-5 times per year
( ) 6-10 times per year
( ) 1-3 times per month
( ) 4-6 times per month
( ) 7-10 times per month
( ) 3-5 times per week
( ) 6-8 times per week
( ) 2-5 times per day
( ) more than 5 times per day

8. When an unusual technological problem occurs, what type of procedure do you use to search for a solution; a systematic procedure (relying on logic, deduction, and analyzed past experience), or an intuitive procedure (relying on unanalyzed experience, intuition, and educated guesses)?

Please check the statement which best describes the method you use.

( ) Always use a systematic procedure
( ) Always use an intuitive procedure
( ) Use a systematic procedure most of the time
( ) Use an intuitive procedure most of the time

9. What field(s) of applied science and engineering are you primarily engaged in?

chemical _____
design _____
electrical _____
industrial _____
mechanical _____
paper(pulp) _____
plastic _____
process _____
research & development _____
other (please specify) _____
_____

10. How effectively have the following forms of continuing education met your needs? (Please rate each form with the following scale)

4-very effective
3-moderately effective
2-slightly effective
1-not at all effective

____college credit courses
____college non-credit course
____seminars
____conferences
____workshops
____self-study
____correspondence courses
____in-service training
____interchange between colleagues
____other forms (Please specify)
_____
_____

11. Did you participate in any continuing education activities in 1978 that were not supported by your company; that is, activities that your company did not sponsor or for which you did not receive support for participation?
Yes_____ No _____

12. If your answer to #11 was yes, what types of organizations sponsored these activities? Check all that apply.

1. College or university . . . . . _____
2. Professional society . . . . . _____
3. Independent educational organization or business providing educational services . . . . . _____
   Name:_____
4. Other . . . . . _____
   Specify:_____
5. Don't know. . . . . _____

13. People have different objectives for participating in continuing education. Please rate each of the following objectives in terms of their importance to you. Use this scale.

4-very important
3-moderately important
2-slightly important
1-not at all important

(a) To maintain your present position in company . . . . . _____
(b) To attain enhanced or authority position in your field . . . . . _____
(c) To perform your present job assignment better. . . . . _____
(d) To prepare yourself for increased responsibility . . . . . _____
(e) To remedy deficiencies in your initial training. . . . . _____
(f) To prepare yourself for a new job in your current field of specialization. . . . . _____
(g) To prepare yourself for a new job in some other field of specialization. . . . . _____
(h) To attain a salary increase . . . . . _____
(i) To fulfill requirements for promotion . . . . . _____
(j) To meet expectations of others . . . . . _____
(k) For intellectual stimulation . . . . . _____
(l) Other (specify)_____ . . . . . _____

14. Work groups (people working under the same supervisor) may be organized by *function*, e.g., a group composed of only engineers, or by *product*, e.g., a group assembling a car.
Please put the percentage of your work time that is spent in each type of work group organization.

Percent of time spent in work group organized by *function* _____%
Percent of time spent in work group organized by *product* _____%

100 %

15. What college credit courses (see definition sheet) did you participate in during the past three years (1976, 1977, 1978)?

Course Content	Degree sought	Which college offered course	What location	When offered	How delivered

Overall, how successful were these college credit courses in meeting your objectives? Use the following rating scale:

4-very successful
3-moderately successful
2-marginally successful
1-unsuccessful

_____

16. What college credit courses would you like offered in the next three years (1979-81)?

Course Title	Which college	What location	When offered	How delivered

What would be the primary motivator for you to enroll in a college credit course?

_____

_____

17. What non-credit courses (see definition sheet) did you enroll in during the past three years (1976, 1977, 1978)?

Course Content	Which college offered course	What location	When offered	How delivered

Overall, how successful were these non-credit courses in meeting your objectives? Use the following rating scale:

4-very successful
3-moderately successful
2-marginally successful
1-unsuccessful

18. What non-credit courses would you like offered in the next three years? (1979-81)?

Course Content	Who should offer	What location	When offered	How delivered

What would be the primary motivator for you to enroll in a non-credit course?

19. What seminars/workshops/conferences (see definition sheet) have you participated in during the past three years (1976, 1977, 1978)?

List Activities:	Who offered	What location	When offered	How delivered

Overall, how successful were these activities in meeting your objectives? Use the following rating scale:

4-very successful
3-moderately successful
2-marginally successful
1-unsuccessful

20. What seminars/workshops/conferences would you like offered in the next three years (1979-81)?

List Activities:	Who offered	What location	When offered	How delivered

What would be the primary motivator for you to participate in a seminar/workshop/conference?

21. What organized self-study/programmed texts/correspondence courses (see definition sheet) have you been involved in during the past three years (1976, 1977, 1978)?

Course Content	Who offered	When offered	How delivered	Credits earned

Overall, how successful were these self-study activities in meeting your objectives? Use the following rating scale:

4-very successful
3-moderately successful
2-marginally successful
1-unsuccessful

_____

22. What organized self-study courses would you like offered in the next three years (1979-81)?

Course content	Who should offer	How delivered

What would be the primary motivator for you to enroll in an organized self-study courses?

_____

_____

PRESIDENT'S QUESTIONNAIRE

1. What field of engineering and applied science are your scientists and engineers primarily engaged in? (Check as many as appropriate).

chemical	____	plastic	____
design	____	process	____
electrical	____	research & development	____
industrial	____	other	____
mechanical	____	_____	____
paper (pulp)	____	_____	____

2. How effectively have the following forms of continuing education met the needs of your company? Rate each using the following scale:

4. very effective
3. moderately effective
2. slightly effective
1. not at all effective

a. college credit courses	____	f. self-study	____
b. college non-credit courses	____	g. correspondence courses	____
c. seminars	____	h. in-service training	____
d. conferences	____	i. other_____	____
e. workshops	____	_____	____

3. Does your company use a formal incentive system for motivating your people to pursue continuing education?

yes ____ no ____

4. How important do you feel are the following reasons for your people who participate in continuing education activities? Rate each using the following scale:

4. very important
3. moderately important
2. slightly important
1. not at all important

a. to perform this present job better ____

b. to prepare for promotion, salary increase or increased responsibility ____

c. personal development ____

d. other reasons:

_____ ____

_____ ____

_____ ____

5. Work groups (people working under the same supervisor) may be organized by function, e.g., a group composed only of engineers, or by product, e.g., a group assembling a car.

Please put the percentage of your scientists' and engineers', technologists' and technicians' time which is spent in each type of work group organization in the appropriate space below.

	Scientists & engineers	Technologists	Technicians
Work group organized by *function*			
What group organized by *product*			
	100%	100%	100%

6. Approximately how many major product changes has your company made in the last five years? (A major product change involves: (1) retooling, and either (2) a change in the material used, or (3) a change in the design or purpose of the product).

Please check one.

( ) 0-10
( ) 11-20
( ) 21-30
( ) 31-40
( ) 41-50
( ) 51-60
( ) 61-70
( ) 71-80
( ) 81-90
( ) 91-100
( ) more than 100--please specify the approximate amount_____

7. How often does your company encounter an unusual technological problem; (i.e., a problem which cannot be solved readily because it is an unfamiliar one)?

( ) less than once per year
( ) 1-5 times per year
( ) 6-10 times per year
( ) 1-3 times per month
( ) 4-6 times per month
( ) 7-10 times per month
( ) 3-5 times per week
( ) 6-8 times per week
( ) 2-5 times per day
( ) more than 5 times per day

8. When an unusual technological problem occurs, what type of procedure does your company use to search for a solution; a systematic procedure (relying on logic, deduction, and analyzed past experience) or an intuitive procedure (relying on unanalyzed experience, intuition, and educated guesses)?

Please check the statement which best describes how your company searches for solutions to unusual technological problems.

( ) Always use a systematic procedure
( ) Always use an intuitive procedure
( ) Use a systematic procedure most of the time
( ) Use an intuitive procedure most of the time

9. Which of the following statements best describes the type of production your company is engaged in? (Please check one).

Unit & Small Batch

___ Production of simple units to customers' orders. (Simple units = units basically single-piece, not assemblies, produced one by one).

___ Production of technically complex units. (Complex units = assemblies, produced one by one).

___ Fabrication of large equipment in stages. (Fabrication, one by one, in which work people come to the unit of output (which moves about very infrequently) rather than the unit moving around to different work people).

Large Batch & Mass

___ Production of small batches. (Small batches = equipment reset every week or more often, for outputs measured in items).

___ Production of components in large batches which are subsequently assembled diversely. (Large batches = equipment reset at intervals longer than a week for outputs measured in items; but a variety of assembly sequences are used).

___ Production of large batches, assembly line type. (Large batches with large batch assembly. Large batches = equipment reset at intervals longer than a week for outputs measured in items).

___ Mass production. (Mass = batch size, measured in items, is indefinite. A change in batch requires decisions on design modification, retooling, etc.).

Process

___ Process production combined with the preparation of a product for sale by large-batch or mass-production methods. (Process = throughputs measured by weight or volume; outputs become items at the finishing stage).

___ Process production of chemicals in batches. (Process, but ingredients of the throughputs change periodically).

___ Continuous flow production of liquids, gases and/or solid shapes. (Process, but ingredients remain constant).

APPENDIX A-6

"Professional Associations Contacted & Instruments"

Professional Associations

Interviewed

1. American Foundrymen's Society
2. American Production and Inventory Control Society, Inc.
3. American Society of Civil Engineers
4. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
5. American Society of Mechanical Engineers
6. American Society for Metals
7. American Society for Quality Control
8. Associated Builders and Contractors
9. Association for Systems Management
10. Fabricating Manufacturers Association
11. Institute of Electrical Engineers, Inc.
12. Instrument Society of America
13. Marinette-Menomonie Manufacturers Association
14. National Association of Home Manufacturers
15. National Machine and Tool Builders Association
16. Numerical Control Society
17. Society for Advancement of Management
18. Society of Die Cast Engineers
19. Society of Manufacturing Engineers
20. Society of Plastics Engineers
21. Society of Vacuum Coaters
22. Society of Women Engineers
23. Standards Engineers Society

Unable to Contact

1. American Chemical Society
2. American Institute of Industrial Engineers
3. American Institute of Plant Engineers
4. American Vacuum Society
5. Engineers & Scientists of Milwaukee, Inc.

Sent Questionnaire

1. American Institute of Chemical Engineers
2. American Management Association
3. American Society of Agricultural Engineers
4. American Society for Metals
5. American Society for Nondestructive Testing
6. American Society for Testing & Materials
7. American Welding Society
8. Chemical Coaters Association
9. Institute of Food Technologists
10. Institute of Paper Chemistry
11. Instrument Society of America
12. National Engine Parts Manufacturer's Association
13. National Society of Professional Engineers
14. Northeast Wisconsin Industrial Association
15. Society of Automotive Engineers
16. Society for Experimental Stress Analysis
17. United Foundrymen of Wisconsin
18. United States Brewers Association
19. Wisconsin State Brewers Association

PROFESSIONAL ASSOCIATION INTERVIEW INSTRUMENT

1. What types of educational or training programs does your association presently offer?

Programs	Location	How Often	Subject area
Workshops Seminars Conferences Meetings Conventions	National Regional State Chapter	Yearly Monthly Weekly	Send Brochure?

2. Could you briefly describe some of the programs that your association plans to offer in the future.

Program	Location	How Often	Subject Area
Workshops Seminars Conferences Meetings Conventions	National Regional State Chapter	Yearly Monthly Weekly	Send Brochure?

3. Do you feel there is support for or need of an Engineering Program in Central and Northern Wisconsin?

A. How Delivered?
   - Professor on site or regional classes
   - Audio Visual
   - Time Frame
     Evening
     Day

B. Where would be the most desirable location?

Name of Society or Association_____

_____

What educational or training programs does your society or association presently offer?

CONTENT OF PROGRAM_____
(subject area)

_____

TYPE OF PROGRAM (workshop, seminar, conference, meetings, correspondence, conventions, etc.)

_____

LEVEL OF PROGRAM (national, regional, state, local)_____

LOCATION OF PROGRAM (city, state)_____

HOW OFTEN OFFERED (times per year)_____

CONTENT OF PROGRAM_____

TYPE OF PROGRAM_____

LEVEL OF PROGRAM_____

LOCATION OF PROGRAM_____

HOW OFTEN OFFERED_____

CONTENT OF PROGRAM_____

TYPE OF PROGRAM_____

LEVEL OF PROGRAM_____

LOCATION OF PROGRAM_____

HOW OFTEN OFFERED_____

CONTENT OF PROGRAM_____

TYPE OF PROGRAM_____

LEVEL OF PROGRAM_____

LOCATION OF PROGRAM_____

HOW OFTEN OFFERED_____

CONTENT OF PROGRAM ____________________

TYPE OF PROGRAM ____________________

LEVEL OF PROGRAM ____________________

LOCATION OF PROGRAM ____________________

HOW OFTEN OFFERED ____________________

CONTENT OF PROGRAM ____________________

TYPE OF PROGRAM ____________________

LEVEL OF PROGRAM ____________________

LOCATION OF PROGRAM ____________________

HOW OFTEN OFFERED ____________________

CONTENT OF PROGRAM ____________________

TYPE OF PROGRAM ____________________

LEVEL OF PROGRAM ____________________

LOCATION OF PROGRAM ____________________

HOW OFTEN OFFERED ____________________

CONTENT OF PROGRAM ____________________

TYPE OF PROGRAM ____________________

LEVEL OF PROGRAM ____________________

LOCATION OF PROGRAM ____________________

HOW OFTEN OFFERED ____________________

CONTENT OF PROGRAM ____________________

TYPE OF PROGRAM ____________________

LEVEL OF PROGRAM ____________________

LOCATION OF PROGRAM ____________________

HOW OFTEN OFFERED ____________________

Please describe briefly the programs that your association or society plans to offer in the near future (the next three to five years).

CONTENT OF PROGRAM ________

TYPE OF PROGRAM ________

LEVEL OF PROGRAM ________

LOCATION OF PROGRAM ________

HOW OFTEN OFFERED ________

CONTENT OF PROGRAM ________

TYPE OF PROGRAM ________

LEVEL OF PROGRAM ________

LOCATION OF PROGRAM ________

HOW OFTEN OFFERED ________

CONTENT OF PROGRAM ________

TYPE OF PROGRAM ________

LEVEL OF PROGRAM ________

LOCATION OF PROGRAM ________

HOW OFTEN OFFERED ________

CONTENT OF PROGRAM ________

TYPE OF PROGRAM ________

LEVEL OF PROGRAM ________

LOCATION OF PROGRAM ________

HOW OFTEN OFFERED ________

CONTENT OF PROGRAM ________

TYPE OF PROGRAM ________

LEVEL OF PROGRAM ________

LOCATION OF PROGRAM ________

HOW OFTEN OFFERED ________

Do you feel there is a need or support for an Engineering program in central and northern Wisconsin? Why or why not?

If you feel that there is need or support for an Engineering program, what method of delivery do you feel would work best?

a new program at a new institution( )
a new program at an existing institution ( )
professors brought on site for regional classes ( )
audio-visual or correspondence approach ( )
other ( ) Please explain:_____

_____

What time frame would be best?

Full time ( )
Part time
Mornings ( )
Afternoons ( )
Evenings ( )
Weekends ( )
Other ( ) _____

What do you think would be the best location? _____

_____

Any other comments? _____

_____

_____

_____

_____

_____

_____

APPENDIX B-1

UNIVERSITY OF WISCONSIN SYSTEM ADVANCED SCIENCE & ENGINEERING DEGREE PROGRAMS

Programs	W. West: Superior	N. Central: Stevens Point	Western: River Falls	Western: Stout	Western: Eau Claire	Western: La Crosse	North East: Green Bay	North East: Oshkosh	South West: Platteville	South West: Madison	South West: Whitewater	South East: Milwaukee	South East: Parkside
Analy. Clinical Chemistry										M			
Applied Computer Science													B
Applied Computer Systems			B										
Applied Mathematics				B									
Appl. Math. Engineering & Physics										B			
Appl. Math & Physics												B	
Applied Science													B
Astronomy-Physics										B			
Bio-Chemistry										B,M,D			
Bio-medical Engineering										M			
Bio-Physics										M,D			
Chemical Engineering										B,M,D			
Chemistry	B	B	B		B	B		B	B	B,M,D	B	B,M,D	B
Chemistry-Business					B								
Chemistry Course										B		B	
Chemistry-Physics							B						
Civil & Environmental Eng.										B,M,D			
Cvl & Environ. Eng. & City Planning										B			
Civil Engineering									B			B	
Computer Science(s)					B	B		B		B,M,D		B,M	
Computer Sci. & Statistics										B			
Electrical Engineering										B,M,D		B	
Engineering										M		M,D	
Engineering Mechanics										B,M,D			
Engineering Science												B	
Engineering Technology													B
Environmental Monitoring										M,D			
Environmental Toxicology										M,D			
Geological Sciences												B,M	
Geology	B				B			B	B	M,D			
Geology & Geophysics										B			
Geophysics										M,D			
Geosciences												D	
Industrial Engineering									B	B,M,D		D	
Industrial Technology			B						B,M				
Light Bldg. Construction									B				
Management Computer Systems											B		
Materials Engineering												B	
Materials Science										M,D			
Mathematics	B	B	B		B,M	B		B	B	B,M,D	B,M	B,M,D	B
Mechanical Engineering									B	B,M,D		B	
Metallurgical Engineering										B,M,D			
Meteorology										B,M,D			
Mining Engineering									B	B,M,D			
Natural Resources		M											
Nuclear Engineering										B,M,D			
Ocean Engineering										M			
Oceanography & Limnology										M,D			
Paper Science		B											
Pharmaceutical Biochemistry										M,D			
Pharmaceutical Chemistry										M,D			
Physical Science					B								
Physics	B	B	B		B	B	B	B	B	B,M,D	B	B,M,D	B
Physics-Chemistry								M					
Physics-Mathematics					B								
Professional Development (eng.)										EGR			
Safety				M,B					B		M		
Science & Broad Area	B		B										
Science-Mathematics			M										
Science & Environmental Change							B						
Statistics										B,M,D			
Water Chemistry										M,D			
Number of Programs in Region	1	1			11			10		22		10	

Code: B = Bachelor's
M = Master's
S = Specialist
D = Doctorate

APPENDIX B-2

University of Wisconsin Center System
Applied Science & Engineering Associate Degree Programs

Located In Study Area	Associate Arts & Sciences Degree
North West	
Barron City	X
North Central	
Medford	X
Marathon City	X
Marshfield/Wood City	X
Western	
None	
North East	
Marinette City	X
Fox Valley	X
Manitowoc City	X
Fond du Lac	X
Sheboygan	X
Washington City	X
Located Outside Study Area	
South West	
Richland	X
Baraboo/Sauk City	X
Rock City	X
South East	
Waukesa City	X

APPENDIX B-3

WISCONSIN VOCATIONAL, TECHNICAL AND ADULT EDUCATION APPLIED SCIENCE & ENGINEERING PROGRAMS

Two-Year Assoc. Degrees	Campuses Located in Study Area																				Campuses Located Outside Study Area									
	North West				North Central						Western				North East																
	Ashland	New Richmond	Rice Lake	Superior	Rhinelander	Antigo	Wausau	Marshfield	Stevens Pnt.	Wis. Rapids	Menomonie	Chippewa Fls.	Eau Claire	La Crosse	Marinette	Sturgeon Bay	Green Bay	Appleton	Oshkosh	Cleveland	Beaver Dam	Fond du Lac	West Bend	Beloit	Elkhorn	Fennimore	Janesville	Kenosha	Madison	Milwaukee	Pewaukee	Racine
Air Conditioning													X	X															X		
Automotive Technicial														X				X										X	X		X
Bio-Medical Electronics														X															X		
Chemical																													X		
Civil - Highway										X							X											X			
Civil Structural													X									X									X
Civil Technol. Public Wks.																													X		
Combustion Engine																													X		
Electric. Pwr. Eng. Technol.										X				X						X											
Electro-Mech. Technology																		X				X							X		
Electronics				X			X						X	X				X		X							X		X	X	X	X
Electronics - Communications																													X		
Electronics - Computer																													X		X
Engine Technology																						X									
Environmental Technician																													X		
Facilities Eng. Technician				X																											
Fire Science									X	X			X	X			X	X		X		X		X			X		X	X	X	X
Fluid Power													X															X		X		
Indus. Eng. Technician							X			X			X	X				X		X							X			X	X	X
Indus. Safety Technician																														X		
Indus. Welding Technology																												X	X			
Instrumentation										X							X												X			X
Laser Technician							X																									
Mechanical Design			X	X			X			X			X	X			X	X		X		X					X	X	X	X	X	X
Metallurgy																													X			
Munic. Eng. Technician																										X						
Paper & Pulp Chem. Technol.																		X														
Plastics Technology																				X									X			
Printing & Publishing														X				X										X	X			
Quality Assur. Technician																	X											X	X			
Security Loss Prevention																													X			
Technical Eng. - Electrical																													X			
Techn. Eng. - Industrial																													X			
Techn. Eng. - Mechanical																													X			
Techn. Eng. - Tooling																													X			
Water & Wastewater																													X			
Water & Wastewater Treatment Technician																						X							X			
Number of Programs in Region	4				11						16				26									57								

Source: Fall 1979 "Opportunities through Vocational, Technical and Adult Education"

APPENDIX B-4

WISCONSIN VOCATIONAL, TECHNICAL AND ADULT EDUCATION APPLIED SCIENCE & ENGINEERING PROGRAMS

Located In Study Area | Located Outside Study Area

Program	Two-Year Diploma	One-Year Diploma	Vocational Diploma	North West: Ashland	New Richmond	Rice Lake	Superior	North Central: Rhinelander	Antigo	Wausau	Marshfield	Stevens Point	Wisconsin Rapids	Western: Menomonie	Chippewa Falls	Eau Claire	La Crosse	North East: Marinette	Sturgeon Bay	Green Bay	Appleton	Oshkosh	Cleveland	Beaver Dam	Fond du Lac	West Bend	Beloit	Elkhorn	Fennimore	Janesville	Kenosha	Madison	Milwaukee	Waukesha	Racine
Aircraft-Electronics	X																												X					
Air Conditioning, Refrig. & Heating			X																													X		
Airframe Mechanics		X																														X		
Airframe & Powerplant Mech.	X																												X	X				
Appliance Servicing		X														X								X				X				X	X	
Autobody	X																				X										X			
		X				X			X	X			X			X	X			X	X		X		X			X	X	X	X	X	X	X	
Automatic Bar & Chucking Machine Operation			X																													X		
Automotive Mechanics	X						X	X		X			X			X				X	X			X				X			X			
Automotive Servicing		X		X		X	X	X	X	X			X			X	X	X		X		X		X				X	X	X	X		X	X
Automotive Servicing Mech.		X																			X														
Automotive Specialists			X	X																															
Auto Parts Specialist		X																		X											X			
Building Materials Spec.		X						X																											
Carbustion Engine		X																														X		
Community Antenna TV Instal. & Maintenance		X				X																													
Dairy Processing Equip. Mech.		X																										X						
Diesel Equip. Mechanic		X																	X		X													
Diesel Equip. Servicing		X														X																		
Drafting-Architectural		X																													X			
Drafting-Mechanical		X				X	X	X				X				X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
Electrical Power Distrib.		X														X																		
Electricity		X																	X															
Electronic Equip. Serv.		X																						X										
Electronic Servicing		X					X				X					X	X				X		X	X				X	X		X	X	X	X
	X									X						X																X	X		
Facilities Maintenance Ser.		X					X																												
Fluid Power Maintenance (Ind. Hydraulics Pneumatics)		X														X					X									X		X		
Horology (Watch Making)	X																															X			
Industrial Diesel Mechanic		X																														X			
Industrial Maintenance	X																																		
Industrial Truck Mechanic		X																	X																
Linotype Maintenance			X																													X			
Loose Molder			X																													X			
Machine Maintenance		X																											X						
Machine Molder & Machine Coremaker			X																													X			
Machine Parts Inspection		X																														X			
Machine Repair		X																							X										
Machine Tooling Technician	X								X		X						X								X										
Machine Tool Operation	X					X	X						X			X				X										X		X			
		X		X	X	X			X	X	X					X		X		X		X	X		X	X			X	X		X	X	X	X
Machine Typesetting		X																														X			
Maritime Construction		X																	X																
Metal Fabrication		X														X					X				X										
Motorcycle Mechanic			X																											X					
Office Equipment Repair		X																															X		
Office Machine Repair		X																							X										
Packaging Machinery Servic.		X				X																													
Powerplant Mechanic		X																															X		
Precision & Materials Insp.		X														X				X															
Presswork		X																															X		
Printing		X															X				X	X											X	X	
	X									X																										
Print. & Publishing - Offset		X																															X		
Production Machine Operation			X																		X														X
Production Welding			X	X		X	X														X			X								X			
Recreational Equip. Servic.		X			X																							X						
Refrigeration Servicing		X															X															X			
Replacement Parts Specialist		X																			X				X										
Small Engine & Chassis Mech.		X				X			X			X					X		X			X	X		X		X	X			X	X	X		
Small Engine Servicing			X																						X										
Steel Metal		X																														X			
Teletypesetter Perforator Op.			X																													X			
Tool & Die Making	X																															X			
Truck-Construction-Indust. Diesel Mechanics	X												X			X	X																		
Vending Equipment Mainten. & Repair		X								X																									
Welding		X				X				X	X		X				X		X	X	X	X	X	X	X				X	X		X	X	X	
Welding Semi-Automatic Wire			X																													X			
Wood Technics	X						X																												
				24				29						25				62									90							230		

APPENDIX B-5

INDEPENDENT WISCONSIN UNIVERSITIES APPLIED SCIENCE & ENGINEERING PROGRAMS

Code: C = Certificate
A = Associate
B = Bachelor's
M = Master's
D = Doctorate

Program Area	Located In Study Area											Located Outside Study Area										
	North West		North Cent.	West	North East							South West	South East									
	Mt. Senario College	Northland College	None	Viterbo College	Institute of Paper Chemistry	Lawrence University	Ripon College	St. Norbert College	Silver Lake College	Lakeland College	Marian College	Edgewood College	Milton College	Alverno College	Cardinal Stritch College	Concordia College	Marquette University	Milwaukee School of Engineering	Mt. Mary College	Beloit College	Carroll College	Carthage College
Bio-Chemistry					M,D												M,D					
Bio-Medical Engineering																		A,B				
Construction Eng. Technol.																						
Chemistry		B		D	M,D	B	B			B	B	A	B	B	B		B,M,D	A	B	B	B	B
Chemical Engineering					M,D																	
Chemical Technology					M,D																	
Civil Engineering																	B,M					
Computer Eng. Technol.																		A				
Electric Power Technol.																		C,A				
Electrical Engineering																	B	B				
Electrical Eng. Technol.																		B				
Electronics Technology																		A				
Engineering																		C,D		B	B	B
Engineering Management																		M				
Environmental Sci./Stud.		B										B										
Fluid Power Eng. Technol.																		A,M				
Geology						B																
Industrial Eng. Technol.																		A				
Materials Science																	B,D					
Mathematics	B	B		B	M,D	B	B		B	B	B	A,B	B	B	B		B,M		B	B	B	B
Mechanical Engineering																	B,M,D	B				
Mechanical Eng. Technol.																		B				
Metals Eng. Technol.																		A				
Natural Science									B													B,M
Non-Destructive Testing																		C				
Paper Chemistry						B																
Paper & Pulp Technology					M,D																	
Physics		B			M,D	B	B			B			B	B			B,M			B	B	B
Science													B							B		
Number of Programs in Region		5		2				30				3						62				

APPENDIX B-6

TECHNICAL PROGRAMS OFFERED OR PLANNED BY PROFESSIONAL & TRADE ASSOCIATIONS 1976-81

Program Area	Recently	Plan to Offer	Type of Delivery	Location	Frequency	Association
Air Distribution	X		Meeting	G B & Appleton	Annual	American Society of Heating, Refrig. & Air Condt. Eng.
Air Traffic Control	X		Meeting with WSPE	Sheboygan or G B	Monthly	American Society of Civil Engineers
Alaska Pipeline	X		Meeting with ASCE	National	Semi-Annual	Wisconsin Society of Professional Engineers
Automobile Eng. Topics	X		Lecture	Milwaukee	Annual	Society of Automotive Engineers (Milwaukee Section)
Automotive Engine Design	X		Meeting	" "	Monthly	American Society for Metals
Biological Wastewater Treatment	X		Meeting	Rotates Fox Valley	Monthly	Instrument Society of America (Fox Valley Section)
Boiler	X		Meeting	G B & Appleton	Monthly	American Society of Heating, Refrig. & Air Condt. Eng.
Bolt Construction in Saudi Arabia		X	Meeting	Unknown	Unknown	American Society of Civil Engineers
Brazing Adhesive	X		Workshop	Fox Valley	Annual	Society of Manufacturing Engineers
Bldg. Construction Topics	X		Convention	Throughout U.S.	Annual	Associated Builders & Contractors
Building Standards	X		Workshop	" "	Quarterly	National Association of Home Manufacturers
Capacity Planning	X		Meeting	Fox Valley	Monthly	American Production & Inventory Control Society
Casting Defects	X		Convention	Milwaukee	Annual	American Foundrymen's Society
Civil Engineering Topics	X		Meeting	Milwaukee	Annual	American Society of Civil Engineers
Combustion Boiler Control		X	Workshop	Rotates in WI	Annual	Instrument Society of America (Fox Valley Section)
Combustion Control	X		Meeting	Rotates Fox Valley	Monthly	" "
Computers	X		Seminar	Throughout U.S.	6 a Year	Numerical Control Society
Computer Matrix Analysis	X		Meeting	Appletun	Bi-Monthly	American Society of Mechanical Engineers
Construction Engineering	X		Conference	Rotates Nationally	Annual	Society of Women Engineers
" "	X		Conference	Milwaukee	Annual	Wisconsin Society of Professional Engineers
Construction Engineering (Heavy)	X		Conference	Rotates Nationally	Annual	Society of Women Engineers
Core Binding Systems (new)		X	Convention	Milwaukee	Annual	American Foundrymen's Society
Design Engineering	X		Conference	Rotates Nationally	Annual	Society of Women Engineers
Die Cast - Cost Control	X		Meeting	Milwaukee	Annual	Society of Die Cast Engineers
Die Industry (3-5 year Projections)	X		Meeting	Milwaukee	Monthly	" "
Die Life - Improving	X		Meeting	Milwaukee	Monthly	" "
Digital Control	X		Meeting	Rotates Fox Valley	Monthly	Instrument Society of America (Fox Valley Section)
" "		X	Workshop	Appleton	Unknown	Institute of Electrical Engineers
Electrical Engineering Topics		X	Conference	Appleton	Unknown	" "
Engineering for High School & College Students	X		Meetings	Area High Schools	Monthly	Society of Women Engineers
Eng. Mining Copper & Zinc	X		Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Environmental Control	X		Meeting	National	Monthly	Institute of Electrical Engineers
" "	X		Meeting	Sheboygan or G B	Monthly	American Society of Civil Engineers
Fabricating Farm & Industry Equipment		X	Seminar/Conf.	Unknown	By Demand	Fabricating Manufacturers Association
Fabricating Tube & Heavy Pipe		X	Seminar/Conf.	Unknown	By Demand	" "
Failure & Fracture of Metals	X		Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Fastening	X		Workshop	Fox Valley	Annual	Society of Manufacturing Engineers
Fatigue Prediction	X		Workshop	Milwaukee	Annual	American Society for Metals
Fiber Optics	X		Meeting	National	Monthly	Institute of Electrical Engineers
Fiber Optics Communication (new)	X		Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Fire & Smoke	X		Meeting	G B or Appleton	Monthly	American Society of Heating, Refrig. & Air Condt. Eng.
Flow Measurement	X		Meeting	Rotates Fox Valley	Monthly	Instrument Society of America (Fox Valley Section)
Food Processing		X	Meeting	Unknown	Monthly	" "
Foundry Topics	X		Convention	Birmingham, AL	Annual	American Foundrymen's Society
Gating Design	X		Seminar	Milwaukee	Annual	Society of Die Cast Engineers
Induction Melting	X		Meeting	Menashe	Monthly	American Foundrymen's Society
Insulation	X		Seminar/Conf.	Ware Location	Annual	National Association of Home Manufacturers
Lasering Aluminum	X		Workshop	Oshkosh	Annual	American Foundrymen's Society
Life Cycle Costing	X		Seminar	Pewaukee, WI	Annual	American Society of Agricultural Engineers
Magnetic Particle	X		12-hr. Course	Green Bay	Annual	American Society for Non-Destructive Testing
Maintenance	X		Meeting	Rotates in N.E. WI	5 a Year	Technical Assoc. of Pulp & Paper Indust. (Lake States)
" "	X		Seminar	Throughout U.S.	6 a Year	Numerical Control Society
Maintenance Clinic	X		Meeting	Rotates Fox Valley	Monthly	Instrument Society of America (Fox Valley Section)
Maintenance - Trade Show	X		Clinic	" "	Annual	" "
Manufacturing Area Topics	X	X	Convention	Regional & Nation.	Annual	Society of Manufacturing Engineers
Materials equirements Plng.	X		Seminar	Appleton	Annual	American Production & Inventory Control Society
Medical Instruments		X	Meeting	Unknown	Monthly	Instrument Society of America (Fox Valley Section)
Metal Fabrication - Plate	X		Conference	Throughout U.S.	Monthly	Fabricating Manufacturers Association
Metal Fabrication - Roll Forming	X		Confetence	" "	Monthly	" "
Metal Fabrication - Sheet	X		Conference	" "	Monthly	" "
Metal Fabrication - Stamping & Designing	X		Conference	" "	Monthly	" "
Metal Fabrication - Structural	X		Conference	" "	Monthly	" "
Metallurgy	X		Meeting	Milwaukee	Monthly	American Society for Metals
Metrics	X		Conference	Los Angeles	Annual	Standards Engineers Society

Program Area	Recently/Plan to Offer/Offer		Type of Delivery	Location	Frequency	Association
Micro-Computers		X	Workshop	Appleton	Unknown	Institute of Electrical Engineers
Micro-Processors	X		Loc. Meet./Nat. Work	Rotates Fox Valley	Monthly	Instrument Society of America (Fox Valley Section)
Milling Machines (new)	X		Entry Training	Giddings & Lewis, Fond du Lac	Each 6-12 Weeks	National Machine & Tool Builders Association
Milling Machines (up grading)	X		Retraining	" "	" "	" "
Mini Computers		X	Workshop	Appleton	Unknown	Institute of Electrical Engineers
" "	X		Courses	Area High Schools	Ea. Semester	Society of Plastics Engineers
Nuclear Engineering		X	Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Numerical Control Topics	X		Convention	Los Angeles	Annual	Numerical Control Society
" "	X	X	Workshop/Seminar	Milwaukee	Bi-Annual	National Machine & Tool Builders Association
Non-Destructive Testing	X		4-Week Course	Milwaukee	Annual	American Society for Metals
Non-Destructive Testing Application	X		Seminar	Green Bay	Annual	American Society for Non-Destructive Testing
Organic Chemistry		X	Course	Area High Schools	Ea. Semester	Society of Plastics Engineers
Paper & Pulp Mill Systems	X		Meeting	Rotates In N.E. WI	5 a Year	Technical Assoc. of Pulp & Paper Indust. (Lake States)
Paper & Pulp Topics		X	Meeting	" "	" "	" "
" "		X	Meeting	Unknown	Monthly	Instrument Society of America (Fox Valley Section)
Parts Production - Group Technology	X		Meeting	Milwaukee	5 a Year	Standards Engineers Society
Penetrant Training	X		8-hr. Course	Green Bay	Annual	American Society for Non-Destructive Testing
Plant Tours	X		Lecture	Milwaukee Sites	Annual	Society of Automotive Engineers (Milwaukee Section)
Plastics, (basic) for High School Studonts	X		Course	Area High Schools	Ea. Semester	Society of Plastics Engineers
Materials	X		" "	" "	" "	" "
Processes	X		" "	" "	" "	" "
Design	X		" "	" "	" "	" "
Power Distribution Systems		X	Workshop	Appleton	Unknown	Institute of Electrical Engineers
Process Energy Controls	X		Meeting	Rotates N.E. WI	5 a Year	Technical Assoc. of Pulp & Paper Indust. (Lake States)
" "	X		Meeting	Rotates Fox Valley	Monthly	Instrument Society of America (Fox Valley Section)
Product Liability	X		Meeting	Milwaukee	Annual	Society of Die Cast Engineers
Production & Inventory Control	X	X	Convention	National	Annual	American Production & Inventory Control Society
Programmable Controler		X	Workshop	Appleton	Unknown	Institute of Electrical Engineers
Quality Control Topics	X		Seminar	Oskhosh	Annual	American Society of Quality Control
" "	X		Meeting	Through. Fox Val.	Monthly	" "
Radio - Benefits of Two-Way		X	Conference	Appleton	Unknown	Institute of Electrical Engineers
Radiography Training	X		40-hr. Course	Green Bay	Annual	American Society for Non-Destructive Testing
Sand Control (advanced)	X		Workshop	Oshkosh	Annual	American Foundrymen's Society
Scrap Control		X	Convention	Milwaukee	Annual	" "
Sewage Treatment - Fox Valley		X	Meeting	Unknown	Unknown	American Society of Civil Engineers
Solar Energy	X		Meeting	G B & Appleton	Monthly	American Society of Heatng, Refrig. & Air Condt. Eng.
" "	X		Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Solid State Reg. Speed Dr.	X		Meeting	National	Monthly	Institute of Electrical Engineers
Sound Construction	X		Meeting	G B & Appleton	Monthly	American Society of Heatng, Refrig. & Air Condt. Eng.
Space Technology		X	Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Standards of Certification for Engineers	X		Meeting	Milwaukee	5 a Year	Standards Engineering Society
Standards Topics		X	Seminar	UW-Milwaukee	Unknown	" "
Steel Making Atmosphere Control	X		4-Week Course	Milwaukee	Annual	American Society for Metals
Steel - New Alloy	X		Meeting	Milwaukee	Monthly	" "
Stress Analysis of Applied Optics	X		Meeting	Appleton	Bi-Monthly	American Society of Mechanical Engineers
Thermodynamics (technical)		X	Meeting	Appleton	Bi-Monthly	" "
Toxic Substance	X		Meeting	Rotates N.E. WI	5 a Year	Technical Assoc. of Pulp & Paper Indust. (Lake States)
Transportation Engineering	X		Conference	Rotates Nationally	Annual	Society of Women Engineers
Tube Fabricating	X		Conference	Throughout U.S.	Monthly	Fabricating Manufacturers Association
Ultrasonic Testing	X		40-hr. Course	Green Bay	Annual	American Society for Non-Destructive Testing
Utilities Engineering	X		Conference	Rotates Nationally	Annual	Society of Women Engineers
U.S. Corps of Engineers	X		Meeting	Sheboygan or G B	Monthly	American Society of Civil Engineers
Vacuum Coating Topics	X		Conference	New Orleans	Annual	Society of Vacuum Coaters
Water Engineering	X		Conference	Rotates Nationally	Annual	Society of Women Engineers
Water Quality in Fox Valley	X		Meeting	Sheboygan or G B	Monthly	American Society of Civil Engineers
reatment	X		Meeting	G B & Appleton	Monthly	American Society of Heatng, Refrg. & Air Condt. Eng.
	X		Workshop	Fox Valley	Annual	Society of Manufacturing Engineers
Quality Inspection	X		11-Week Course	UW-Milwaukee	Annual	American Society for Metals

APPENDIX B-7

NON-TECHNICAL PROGRAMS OFFERED OR PLANNED BY PROFESSIONAL & TRADE ASSOCIATIONS 1976-81

Program Area	Recently/Plan to Offered/Offer		Type of Delivery	Location	Frequency	Association
Affirmative Action	X		Meeting	Thru-out State	2 a Year	Associated Builders & Contractors
Apprenticeships	X		Meeting	Thru-out State	2 a Year	" "
Associate Degree	X		64 cr. Sequence	NWTI-GB	Every Sem.	Marinette-Menominee Manufacturers Association
Business Courses		X	Short Courses	Madison	Unknown	American Society of Civil Engineers
Business, Succession upon Loss of Owner		X	Conference	Unknown	Upon Request	Associated Builders & Contractors
Communication	X		Seminar/Conf.	Warm Location	Annual	National Association of Home Manufacturers
Communications		X	Workshop	Thru-out U.S.	6-10 a Year	" "
Humanize		X	" "	" "	" "	" "
Perceptions		X	" "	" "	" "	" "
Images		X	" "	" "	" "	" "
Values		X	" "	" "	" "	" "
Construction Sites Tours	X		Meeting	Milwaukee	Annual	American Society of Civil Engineers
Economic Forecast	X		Meeting	Virginia	Semi-Annual	National Machine & Tool Builders Association
Economics, National	X		Meeting	Virginia	Semi-Annual	" "
Energy Conservation	X		Workshop	Regional	Annual	American Soc. of Heatng., Refr. & Air Condt. Eng.
	X		" "	Milwaukee	" "	American Society for Metals
Energy Conservation Standards	X		Meeting	Milwaukee	5 a Year	Standards Engineers Society
Energy Crisis	X		Meeting	Virginia	Semi-Annual	National Machine & Tool Builders Association
Energy Savings	X		Meeting	" "	" "	" "
The Engineer in Court	X		Seminar	Pewaukee WI	Annual	American Society of Agricultural Eng. (Wiscn.)
Engineers - Salaries, Management-Employment of	X		Meeting	Milwuakee	Annual	American Society of Civil Engineers
Facilities Tours of Govt. & Bus.	X	X	Convention	Milwaukee	FDL or Marinette	Wisconsin Society of Professional Engineers
Government Policy	X		Convention	Milwaukee	Annual	" "
Insurance Bonding		X	Conference	Unknown	Upon Request	Associated Builders & Contractors
Labor Relations	X		Workshop	Thru-out U.S.	Quarterly	National Association of Home Manufacturers
	X		Seminar	40-mile Radius	12-15 a Year	Associated Builders & Contractors
Legislation - New	X		Workshop	Fox Valley	Upon Request	" "
Management	X		Seminar/Conf.	Warm Location	Annual	National Association of Home Manufacturers
	X	X	Workshop	Fox Valley	Upon Request	Associated Builders & Contractors
Management - Effective		X	Workshop	Thru-out U.S.	6-10 a Year	" "
Management, Energy Impact On	X		Meetings	Virginia	Semi-Annual	National Machine & Tool Builders Association
Management Styles		X	Workshop	Thru-out U.S.	6-10 a Year	National Association of Home Manufacturers
Management Training	X		Workshop	" "	Quarterly	" "
Market Analysis	X		" "	" "	" "	" "
Motivation, Behavior & Understanding	X		Seminar	Pewaukee WI	Annual	American Society of Agricultural Eng. (Wiscn.)
Motivation - Individual		X	Workshop	Thru-out U.S.	6-10 a Year	National Association of Home Manufacturers
Motivation - Self	X		Meeting	Virginia	Semi-Annual	National Machine & Tool Builders Association
Officer Training	X	X	Convention	Regional & Nat.	Annual	Society of Manufacturering Engineers
OSHA Safety Topics	X		Meeting	Thru-out State	2 a Year	Associated Builders & Contractors
Physical Fitness	X		Meeting	Virginia	Semi-Annual	National Machine & Tool Builders Association
Power & Leadership		X	Workshop	Thru-out U.S.	6-10 a Year	National Association of Home Manufacturers
Problem Solving, Creative	X		Seminar	Brillian WI	Occasional	Wisconsin Society of Professional Engineers
Professionalism (Ethics)	X	X	Meeting	Sheboygan or GB	Monthly	American Society of Civil Engineers
Supervision	X	X	Workshop	Fox Valley	Upon Request	Associated Builders & Contractors
Supervisory Parsuasive Training		X	Workshop	Thru-out U.S.	6-10 a Year	National Association of Home Manufacturers
Supervisory Training	X		Seminar/Conf.	Warm Location	Annual	" "
Time, Effective Use of	X		Seminar	Pewaukee WI	Annual	American Society of Agricultural Eng. (Wiscn.)
Transactional Analysis		X	Workshop	Thru-out U.S.	6-10 a Year	National Association of Home Manufacturers
Value Engineering	X		Seminar	Pewaukee WI	Annual	American Society of Agricultural Eng. (Wiscn.)
Wage Rates - Prevailing	X		Meeting	Thru-out State	2 a Year	Associated Builders & Contractors

APPENDIX B-8

Specific Applied Science & Engineering Courses
Offered by UW - Extension

Course Title	Credit/Non-Credit	Years Offered
Via the State Extension Education Network (SEEN)		
Concrete Beam Design (review of ACI 318-77)	X	1979-80
Construction (legal aspects)	X	1977-78
Construction & Municipal Operations (noise control & hearing conservation)	X	1979-80
Consumers Conference	Public Service	1977-78
Electrical & Lighting Safety	X	1977-80
Energy Audits Survey	X	1977-78
Energy Management	X	1979-80
Energy (residential)	X	1977-78
Engine Mechanics	X	1977-78
Engineering Mechanics	X	1977-78
Engineering Mechanics: Dynamics	X	1979-80
Engineering Mechanics: Survey	X	1978-80
Engineering Refresher (basic)	X	1977-79
Environmental Impact Statement	X	1977-78
Fatigue Failures	X	1979-80
Hydraulics (basic)	X	1977-78
Industrial & Manufacturing Engineering Refresher	X	1979-80
Insulation: Materials & Standards (residential)	X	1978-79
Life-Cycle Costing	X	1977-78
Life-Cycle Costing - A Practical Use Of Engineering Economy	X	1979-80
Mathematics Analysis (applied)	X	1979-80
Metallurgy (applied)	X	1979-80
Metric System (workshop)	X	1978-79
Products Liability	X	1977-79
Project Management Methods	X	1977-78
Public Works Engineering Practices	X	1979-80
Public Works Inspection	X	1979-80
Public Works Management	X	1977-78

Course Title	Credit/Non-Credit		Years Offered
Sanitary Landfill		X	1978-79
Sewer & Water Construction Contracts (federally assisted)		X	1978-79
Shallow Foundation Analysis And Design		X	1978-80
Sludge Management Practices (municipal)		X	1979-80
Soil Mechanics & Foundations		X	1977-78 & 79-80
Solar Energy Design (passive)		X	1979-80
Solid Waste Management		X	1978-79
Statistical Methods	X		1977-78
Surface Mining - Introduction		X	1978-79
Technical Communications		X	1977-79
Time Utilization Engineering		X	1977-80
Toxic Hazardous Waste		X	1977-78
Underground Housing (fall & spring)		X	1979-80
Value Engineering		X	1979-80
Wind Energy Conversion Systems		X	1979-80
Via Educational Telephone Network (ETN)			
Arc Welding Processes & Their Application (fall & spring)		X	1979-80
Corrosion & Protection of Metals		X	1979-80
Energy Audit Refresher (residential)		X	1979-80
Insulation (residential)		X	1979-80
Underground Housing		X	1978-79
" " (fall & spring)		X	1979-80
Via Video Cassette			
Calculus - basic		X	
Calculus - intermediate		X	
Circuits - logical though & logic	X	X	
Digital Technology		X	
Environmental Engineering Series		X	
Materials Science	X	X	
Weather & Climate	X	X	

Course Title	Credit/Non-Credit	Years Offered
Via Short Courses Inside Study Area		
Boiler Efficiency Workshop		
Eau Claire	X	1978-79
Green Bay	X	" "
Green Lake	X	" "
Rhinelander	X	" "
Rice Lake	X	" "
Sheboygan	X	" "
Stevens Point	X	" "
Superior	X	" "
Wausau	X	" "
West Bend	X	" "
Educational Facilities Energy Conservation		
Eau Claire	X	1978-79
Fond du Lac	X	" "
Stevens Point	X	" "
Effective Zoning Administration		
Wausau	X	1976-77
Energy Code Workshop		
Eau Claire	X	1978-79
Stevens Point	X	" "
On Site Treatment		
Stevens Point	X	1976-77
Wausau	X	1977-78
Wastewater Treatment		
Marshfield	X	1977-78
Via Independent Study Courses		
Chemistry		
General Chemistry I	X	
General Chemistry II	X	
Computer Science		
Fundamentals of FORTRAN Programming	X	
Civil Engineering		
Critical Path Network Techniques	X	
Elementary Surveying I	X	
Elementary Surveying II	X	
Advanced Surveying	X	
Concrete Structures	X	
Photogrammetry	X	

Course Title	Credit	Non-Credit	Years Offered
Philosophy, Policy & Problems in Environmental Engineering		X	
Water & Wastewater Treatments		X	
Air Pollution & Solid Wastes		X	
Occupational Health & Hygiene		X	
Environmental Engineering Topics		X	
Introduction to Construction Specification Writing		X	
Engineering Graphics and Engineering Drawing			
Principles of Architectural Drawing		X	
Practical Mathematics			
Shop Arithmetic I		X	
Practical Arithmetic		X	
Practical Mathematics for Electricity I		X	
Practical Mathematics for Electricity II		X	
Engineering Mechanics			
Statistics	X		
Dynamics	X		
Mechanics of Materials	X		
General Engineering			
Technical Writing I	X		
Technical Writing II	X		
Technical Writing III	X		
Technical Writing I & II	X		
Technical Writing II & III	X		
Technical Writing I, II & III	X		
Basic Engineering Refresher		X	
Mechanical Engineering			
Principles of Industrial Engineering	X		
Introduction to Numerical Control	X		
Automotive Engines		X	
Automotive Chassis		X	
Diesel Engines		X	
Safety Supervision	X		
Safety Engineering		X	
Safety Management		X	

Course Title	Credit	Non-Credit	Years Offered
Steam Plant Operation		X	
The Art & Science of Welding		X	
The Art & Science of Welding Inspection I		X	
The Art & Science of Welding Inspection II		X	
The Art & Science of Welding Inspection III		X	
Introduction to Quality Control		X	
Introduction to Value Analysis And Engineering		X	
Metallurgical & Minerals Engineering			
Introduction to Materials Science	X		
Geology			
General Geology	X		
Mathematics			
Intermediate Algebra	X		
Analytic Geometry	X		
Introductory Mathematics of Finance & Probability	X		
College Algebra	X		
Plane Trigonometry	X		
Algebra & Trigonometry	X		
Introductory Mathematics of Finance	X		
Introductory Finite Probability	X		
Numbers & Basic Operations		X	
Linear Equations & Inequalities		X	
Factoring, Fractions & Exponents		X	
Radicals, Complex Numbers & Quadratics		X	
Graphs & Systems of Equations		X	
Review of Intermediate Algebra		X	
Functions I		X	
Functions II		X	
Polynomial Equations		X	
Systems of Equations & Inequalities		X	
Trigonometric Functions: Theory		X	
Trigonometric Functions: Applications		X	

Course Title	Credit/Non-Credit		Years Offered
Calculus & Related Topics I		X	
Calculus & Analytic Geometry I		X	
Calculus & Analytic Geometry II		X	
Calculus & Analytic Geometry III		X	
Differentiation		X	
Applications of the Derivative		X	
Basic Integration		X	
Applications of Integration		X	
Transcendental Functions		X	
Integration Techniques		X	
Plane Curves		X	
Polar Coordinates & Vectors		X	
Limits & Approximations		X	
Infinite Series		X	
Vectors		X	
Curves & Surfaces		X	
Partial Differentiation		X	
Multiple Integration		X	
Differential Equations		X	
Topics in Single Variable Calculus		X	
Topics in Multi-Variable Calculus		X	
Probability & Statistics	X		
Introduction to Differential Equations	X		
Directed Study	X		
Geometry I		X	
Geometry II		X	
Review of College Algebra		X	
Review of Trigonometry		X	
Review of Basic Calculus		X	
Review of Intermediate Calculus		X	
Review of Vector Calculus		X	
Meteorology			
Weather & Climate	X		
Physics			
General Physics I	X		
General Physics II	X		

Course Title	Credit/Non-Credit	Years Offered
Statistics		
Introduction to Statistical Methods	X	
Technical Courses - Continuing Education		
General Aeronautics		X
Fundamentals of Electricity		X
Introduction to Refrigeration		X
Air Conditioning I		X
Air Conditioning II		X
Air Conditioning III		X

APPENDIX B-9

Technical - Non-Technical and Informal - Formal
Continuing Education Activities Offered at Industrial Sites

	Formal Activities	Informal Activities
TECHNICAL	1. Seminars by specialists	1. Staff meetings on new information
	2. Training films	2. On-the-job training
	3. Slide presentations	3. Suggested readings
	4. Apprenticeships	4. Problem solving
	5. Corporation H.Q. programs	5. Self-study courses
	6. Training manuals	6. Trade journals & books
	7. Professional consultants	7. Weekly meetings
	8. Customer training courses	8. Equipment suppliers seminars
	9. Service course	9. Maintenance courses
	10. Special topics by trade assoc.	10. Other companies meetings on personnel
	11. C.E. for maintenance and journeymen	11. Customer meetings on new machines
	12. Private individuals teach courses	12. Production schedule meetings
	13. Refrigeration training program	13. New machine brochures
	14. Formal training program	14. Public or private industry literature
	15. Programs based on needs assessment	15. Refresher course for engineers
	16. Information sharing	16. New techniques tape series
	17. Sponsor seminars	17. Customer visits of vendor plant
	18. Chemistry, math & evolutionary processes seminars	18. Electrical & electronic maintenance course
	19. Wedding & micro-processing	19. Sales people product demo.
	20. Extensive orientation for S/E	20. Library
NON-TECHNICAL	1. Management by objectives meetings	1. First aid & CPR training
	2. Management seminars by NMA	2. Safety self-programmed text
	3. Supervision workshop by parent co.	3. Human relations meetings
	4. Supervision & management seminars	4. Production & promotion meetings
	5. Kepner & Trigor courses on supervision & management	5. Management sessions
	6. Business professional workshops	6. New personnel & customer training
	7. Personal development programs	

APPENDIX C-1

Specific Courses Taken or Needed by Scientists and Engineers

I. Bioengineering (Biochemical)

Bacteriology
Brewing
Brewing processing
Bulk canning
Fermentation technology
Food processing/food science
Microbiology
Microscopy
Sanitation

II. Business Administration

Accounting
Advertising/copywriting
Basic building operation/housing construction
Budget planning
Business administration
Business strategy
Construction (legal aspects)
Cost accounting/analysis
EEOC topic related to Corporate Law
Employee motivation
Employee strikers trust plans
Exporting
Finance
Finance and accounting for non-financial managers
Financing a rapidly growing company's growth
Human resources management
Incorporation
Industrial psychology
Interviewing
Labor relations/collective bargaining/employee relations
Managing change and leadership
Management and manpower
Management for Professional Engineers
Management research & engineering estimating
Management/supervisory
Marketing/sales
Organization and management for small design firm
Patent and related law courses
Performance reviews
Personnel
Product liability exposure
Profit sharing/incentive systems
Purchasing

Salary administration
Sales management
Small business operation (basics)
Supervising supervisors
Supervisory skills for foremen
Tax changes
Trade
Trade Association activities
Unions, structure & working and their relationship to industry

III. Chemical Engineering

Adhesions
Air dynamics
Asphalt
Chemical Coaters Association
Chemical engineering
Chemical engineering for non-chemical engineers
Chemical engineering in plastics
Chemical processes
Chemical reactor design
Chemical safety
Computerization of chemical processes
Cooling water treatment
Energy (conservation)
Extraction, study of
Fluids
Foam coating
Industrial air handling
Laminar of dissimilar plastics
Oxygen plant operation and control
Oil technology engineering (design)
Pipe layout and systems and corrosion resistance
Piping design
Plastics analysis seminar
Plastics and application
Plastics engineering
Plastics (reinforced composites)
Plastics (transport and sorption)
Polymer additives (study)
Polymer (elasticity)
Polymer (reology)
Process control
Process design and engineering
Pump application
Pump life and maintenance
Thermodynamics
Thermoplastics (new developments)
Thermoset
Thermoset molding

IV. Chemistry

American Chemical Society meeting
Analytical chemistry methods
Analytical conference (Pittsburgh)
Biochemistry
Chemistry
Corrosion
C13 NMR workshop
Gas chromatography
Gas chromatography, liquid chromatography
Gas chromatography - MS level
Glass capillary gas chromatography
HPLC and thermal analysis
Organic chemistry (advanced)
Paint and paint processing
Polymer science/chemistry
Radiation curing
Spectroscopy
Surface chemistry

V. Computer Science, Computer Control

Coding techniques
Computer-instrument interfacing
Computerization of cost control
Computer programming/computer science
Computers and/or management systems
Computers for foundry work
Micro-processors; related to industry
Numerical control

VI. Electrical Engineering

Electrical/electricity
Electrical engineering
Electrical engineering for non-electrical engineers
Electronics
Electronic pneumatics
Power distribution system for industry (design)
Power engineering
Protective relay seminar
Numerical control
Short circuit calculations for industrial plants

VII. Environmental Engineering

Air controllers (programmable)
Air pollution control
Building a contemporary society
Environmental engineering
Industrial hygiene
Natural gas (end use allocation)
Noise control in the process industries
OSHA regulations

Pest control application
Pellitizing & briquetting (conference)
Plant sanitation
Safety training
Sanitary engineering (state code refresher)
Sanitation
Structural design; sanitary engineering facilities
Waste recovery/pollution control/air pollution

VIII. Industrial Engineering

Building retrofit
Color control
Cost analysis
Facilities engineering
Finite elements (industrial application)
Fleet management
Hazardous material transportation/hazardous materials
Health/safety (employee)
Industrial engineering
Industrial refrigeration
Instrumentation
Inventory control
Maintenance
Maintenance planning
Manufacturing cost estimating
Manufacturing engineering
Manufacturing systems (flexible)
Materials control
Material requirements planning
Measurement of appearance
Measurement of indirect labor
Methods/improvement
Methods and standards
Money factors (Engineering)
New product introductions (managing)
Operations and management (Federal guidelines)
Packaging line
Performance appraisal
Plant layout
Preventive maintenance
Production engineering
Production in jobbing foundaries
Production planning
Production and inventory control
Productivity work measurement
Project control
Project engineering management
Quality control
Quality control (role of quality)
Quality engineering

Scheduling
Structural design
Structural design; industrial facilities
Systems implementation
Time management (personal)
Time study
Time utilization
Traffic and Shipments

IX. Mechanical Engineering

American Society of Mechanical Engineers SOC. VII workshop
Automatic control
Basic refrigeration (Vollrath related)/refrigeration
Boilers
Boilers and refrigeration
Carbide seminar
Combination of mechanical and electrical
Control engineering
Designing machine drive systems
Designing weldments
Drive and mechanical systems
Equipment re-design
Engineering/boilers
Fabrication procedures
Fabrication topics
Fatigue failure analysis
Fire-heating engineering
Flow induced vibration workshop
Fluid power system design
Gear systems (effective design and application)
Guage design
Heat transfer
Hydraulics
Injection mold design
Instrumentation and control
Manufacturing processes
Material bulk handling
Mechanical design
Mechanical engineering
Mold and tool design
Nozzle shell analysis techniques (review)
Nuclear engineering
Pneumatic conveyor systems
Power drive train hydraulics
Power technology & pneumatics conveyor
Refrigeration
Steel fabrication
Stress fundamentals (non-destructive testing)
Systematic layout planning
Thin shell structures
Test procedures
Tube-working procedures (basic)

X. Metallurgical Engineering (Metallurgy)

Foundry I
Foundry practices
Foundry principles
Heat treating
Heat treating materials
Manufacturing tooling, metallurgy, internal combustion engines
Metal decoration
Metallurgy
Post-magnetron sputtering on a production basis
Rutherford can decoration
Vacuum coaters (proceedings of society)
Vacuum metalizing
Vacuum plating topics

XI. Paper and Pulp Technology

Computerized jet printing
De-inking
Flexography
Ink technology workshop
Paper mill processes
Paper/pulp subjects
Paper science
Problems of packaging
Pulping conference
Woodlot management

XII. Personal Development/Non-Technical

Agriculture
Art, dance, drama or photography
Astrology
Bar management
Behavioral science
Bible study/liturgy
Body language
Brainstorming
Career development
Certification program
Chinese cooking
Communication skills
Cultural development
Dale Carnegie
Decision making
Discipline (continuing)
Economics
EMT - aid to injured
Engineering refresher for Professional Engineers
English

First aid
First aid & CPR
Foreign language
French civilization
German
Golf
Human relations
Improved performance (coaching)
Literature searching - for research
Material science - MS level
Mechanisms (history)
Motivation course
Personal development
Personal finance
Positive mental attitude seminar
Problem solving
Professional services - sales
Psychology
Psychology - developmental
Psychology (introduction)
Quality work - desire to do
Related topics
Report writing
Scientist/Engineer skills - upgrading
Space exploration
Specifications - written
Special problems
Speed reading
Sociology
Technical degree (advanced)
Technology - recent developments
Total living concepts - personal development
Written communication

XIII. Physics (Engineering Mechanics/Mathematics)

Applied differential equations
Computer-instrument interfacing
Dynamics
Kinematics
Lasers
Math
Math skills - improvement
Mechanics
Metric system
Physics
Physics or engineering (basic)
Solar design/solar energy
Statistics
Strength of materials

XIV. Professional Development

Professional engineer exam (preparation)
Professional engineer exam refresher
Professional engineer exam review

XV. Vocational and Technical Courses

Architectural/drafting, design/blue print reading
Auto body work
Automotive repair
Blue print and flow sheet reading
Burner workshop
Business writing
Engine mechanics/small engine repair
General science degree, technologist degree
Graphic arts
Heat, ventilation, air conditioning
Lithography
Math, reading, writing - basic courses
Machine shop
Machinist instruction
New automated machines - operation
Office skills - basic
Offset printing
Printing course - basic and refresher
Printing techniques and procedures
Reading & writing skills
Sheet metal drafting
Sheet metal work
Snowmobile repair
Technical areas - basic
Technical topics
Technical writing
Technology - A.A. degree
Tools (use)
Welding and codes
Woodworking

APPENDIX C-2

Continuing Education Subject Content Participated In
And Needed As Viewed By Middle Management

(N = 192)

TOPIC CATEGORIES	Credit Courses		Non-Credit Courses		Seminars, Conferences, Workshops		Organized Self-Study Courses		TOTAL ALL COURSES	
Technical:	Taken	Want	Taken	Want	Taken	Want	Taken	Want	Taken	Want
Bioengineering	0	0	0	0	2	0	0	0	2	0
Chemistry	1	1	0	3	5	1	1	0	7	5
Chemical Engineering	3	5	2	7	15	13	0	1	20	26
Computer Science	3	3	4	5	9	6	3	5	19	19
Electrical Engineering	1	5	3	3	4	5	1	1	9	14
Environmental Engineering	0	4	1	1	15	5	1	0	17	10
Industrial Engineering	4	4	9	8	25	15	0	2	38	29
Mechanical Engineering	1	10	3	11	13	7	1	4	18	32
Metallurgical Engineering	0	5	1	3	5	7	0	2	6	17
Physics (Eng. Mech./Math)	3	14	1	5	11	8	0	0	15	27
Pulp & Paper Technology	1	1	2	1	9	3	0	1	12	6
Vocation & Technology	5	3	3	5	9	10	2	2	19	20
Subtotal	22	55	29	52	122	80	9	18	182	205
Non-Technical:										
Business Administration	11	20	15	8	46	29	8	3	80	60
Personal Development	7	2	10	4	16	8	3	4	36	18
Subtotal	18	22	25	12	62	37	11	7	116	78
GRAND TOTAL	40	77	54	64	184	117	20	25	298	283

APPENDIX C-3

Types of Organizations Offering Continuing Education, & Top Management & Employees (N=116) Past Participation & Future Needs

Organization	Past	Future
UW EXTENSION	10	19
UW SYSTEM (4-Year)		
General	8	27
In Study Area		
Superior	0	2
Stevens Point	1	1
River Falls	1	5
Stout	1	5
Eau Claire	7	7
La Crosse		
Green Bay	1	3
Oshkosh	25	34
Subtotal	36	57
Outside Study Area		
Platteville		
Madison	11	1
Whitewater		
Milwaukee	2	0
Parkside		
Subtotal	13	1
UW CENTER SYSTEM (2-Year)		
General	-	None -
In Study Area		
Marinette	4	2
Sheboygan	1	0
Marathon	0	2
Manitowoc	0	4
Subtotal	5	8
Outside Study Area		
Baraboo/Sauk	1	1

Organization	Past	Future
VTAE SYSTEM (2-Year)		
General	10	19
In Study Area		
Indianhead District	0	18
North Central District	6	7
District #1	4	0
Western District	4	5
Fox Valley District	21	9
Lakeshore District	10	4
Moraine Park District	2	0
Subtotal	47	43
Outside Study Area		
None	-	-
PRIVATE WISCONSIN UNIVERSITIES		
In Study Area		
Lawrence University	1	0
Outside Study Area		
Marquette University	2	0
Mil. School of Engineering	1	0
Madison Business College	1	0
Subtotal	4	0
NON-WISCONSIN UNIVERSITIES		
University of Minnesota	3	4
University of Michigan	1	0
Ohio State University	1	0
Gustavus Adolphus	1	0
St. Thomas	4	0
VT of St. Paul, Minn.	2	0
Minnesota Drafting Inst.	0	1
University in S.E., USA	1	1
University in Mid-West, USA	2	0
University in N.E., USA	1	0
Subtotal	16	6

Organization	Past	Future
PROFESSIONAL ASSOCIATIONS		
American Institute of Electrical Engineering	2	0
American Institute of Industrial Engineering	1	0
American Society for Metals	1	0
Instrument Society of America	3	0
Amer. Inst. of Chemical Eng.	3	0
U.S. Brewers Association	1	0
Chemical Coaters Association	1	0
American Welding Society	2	0
Tech. Association of Pulp & Paper Industry	4	0
American Management Association	6	0
National Engine Parts Manufacturing Association	1	0
Associated Builders and Contractors	1	0
American Chemical Society	3	1
American Foundrymen's Society	4	0
Numerical Control Society	1	0
National Machine and Tool Builder's Association	2	0
N.E. Wiscon. Industrial Assoc.	2	0
Society of Manufacturing Eng.	4	0
Society of Plastics Engineers	6	4
Flexographic Technical Assoc.	1	0
Fabricating Manufacturing Assoc.	1	0
Plastics Institute of America	1	0
National Petroleum Refiners Association	2	0
Marinette-Menominee Manufacturing Association	1	0
Twin City Purchasing Association	2	0
American Society of Mechanical Engineers	0	3
Others Not Specified	14	4
Subtotal	70	12

	Past	Future
OTHERS		
Parent Company or Sample Company	47	4
Manufacturing Private Industry	77	10
Educational Private Industry	12	2
Government gencies	8	0
Consulting Firsm	4	0
Trade Journals	5	0
Local Service Organizations	2	0
Chambers of Commerce	1	0
Most Qualified Agencies	3	26
Local High Schools	0	3
Subtotal	159	45
GRAND TOTAL	380	238

APPENDIX C-4

Types of Organized & Continuing Education Activities
Middle Management Participated in (Past)
& Would Like Offered in the Future (N=192)

	Number Responding									
	Credit Courses		Non-Credit Courses		Seminars Conferences Workshops		Organized Self-Study		TOTAL	
	Past/Future		Past/Future		Past/Future		Past/Future		Past/Future	
UW EXTENSION			5	3	5	1	0	1	10	5
UW SYSTEM (4-Year)										
General	0	4	0	7	5	3	0	2	5	16
In Study Area										
Superior	0	0			0	1			0	1
Stevens Point	3	5	1	3	1	1			5	9
River Falls	5	6	0	4	0	2			5	11
Stout	1	0	1	0					2	0
Eau Claire	2	3			0	3	1	0	3	6
La Crosse	0	0							0	0
Green Bay	0	3			3	0			3	3
Oshkosh	12	24	___	___	0	2	___	___	12	26
Subtotal	23	45	2	13	9	12	1	2	35	72
Outside Study Area										
Platteville	0	0							0	0
Madison	0	3	6	0	16	3			22	6
Whitewater	0	0							0	0
Milwaukee	3	0	1	0	6	0			10	0
Parkside	0	0	___	___	___	___			0	0
Subtotal	3	3	7	0	22	3			32	6
UW CENTER SYSTEM										
General			0	3					0	3
In Study Area										
Marinette	0	1	1	0	1	0			2	1
Fox Valley	0	1	6	2	0	1			6	4
Fond du Lac	1	3	0	6					1	9
Sheboygan	0	4	0	5	___	___			0	9
Subtotal	1	9	7	16	1	1			9	26
Outside Study Area										
None	-	-	-	NONE	-	-	-	-	-	-
VTAE SYSTEM										
General					1	0	2	2	3	2
In Study Area										
Rhinelander			2	0					2	0
Wausau	1	0	2	0					3	0
Stevens Point					3	1			3	1
Wisconsin Rapids			1	0	1	0			2	0
Eau Claire	1	0	1	0	0	1	0	1	2	2
Appleton	2	3	6	0					8	3
Cleveland					1	0			1	0
Fond du Lac	2	1	___	___	2	1	___	___	4	2
Subtotal	6	4	12	0	8	3	2	3	28	10
Outside Study Area										
None	-	-	-	NONE	-	-	-	-	-	-
PRIVATE WISCONSIN INSTITUTIONS										
In Study Area										
Lakeland College	0	1							0	1
Outside Study Area										
Marquette Univ.	2	0			4	0			6	0
Mil. School of Engineering	___	___	1	0	2	0			3	0
Subtotal	2	1	1	0	6	0			9	1

	Number Responding									
	Credit Courses		Non-Credit Courses		Seminars Conference Workshops		Organized Self-Study		TOTAL	
	Past/Future		Past/Future		Past/Future		Past/Future		Past/Future	
NON-WISCONSIN UNIVERSITIES										
Univ. of Minnesota	2	0			4	0			6	0
Univ. of Michigan			1	0					1	0
Univ. of Northern Iowa			1	0					1	0
VT of Red Wing Minnesota			3	0					3	0
Iowa State Univ.	1	0							1	0
Gustavus Adolphus					1	0			1	0
St. Thomas					1	0			1	0
Rochester Institute Of Technology					2	0			2	0
Univ. in S.E., USA	1	0							1	0
Univ. in Mid-West USA	2	0							2	0
Univ. in West, USA					1	0			1	0
Univ. in N.E., USA	___	___	___	___	3	0			3	0
Subtotal	6	0	5	0	12	0			23	0
PROFESSIONAL ASSOCIATIONS										
General					3	0			3	0
Society of Plastics Engineers			1	2	5	5			6	7
American Institute of Industrial Eng.					2	0			2	0
Amer. Production & Inventory Control Society					1	0			1	0
Amer. Soc. of Mech. Engineers					4	0			4	0
Instrument Society of America					1	0			1	0
Amer. Institute of Chem. Eng.					2	0			2	0
National Society of Professional Eng.					1	0	1	0	2	0
Chemical Coaters Association					1	0			1	0
Technical Assoc. of Pulp & Paper Indus.					9	5	1	1	10	6
Amer. Foundrymen's Society					4	0			4	0
National Assoc. of Home Manufacturers					1	0			1	0
Numerical Control Society					1	0			1	0
Soc. of Manufac. Eng.					1	0			1	0
Soc. of Vacuum Coaters					1	0			1	0
Soc. of Plastics Industries					3	0			3	0
International Powder Inst.					3	0			3	0
Printer Industries of America					1	0			1	0
Amer. Management Association					1	0	2	0	3	0
Flexographic Tech. Association					3	0			3	0
National Refinery Association	___	___	___	___	2	0	___	___	2	0
Subtotal	0	0	1	2	50	10	4	1	55	13
OTHERS										
Parent Co./Co. Itself			1	3	23	0	1	0	25	3
Manuf. Private Indus.			0	1	30	5	2	0	32	6
Any Organization Qualified	0	1	0	3	0	7			0	11
Consulting Firms					3	0			3	0
Government Agency					7	1	1	0	8	1
Education, Private Industry					7	3	2	0	9	3
Chambers of Commerce	___	___	___	___	1	0	3	3	4	5
Subtotal	0	1	1	7	71	14	9	3	81	25
GRAND TOTAL	41	63	41	39	199	44	16	12	282	258

APPENDIX D

Company Continuing Education
Past Expenditures and Future Allocations

APPENDIX D-1

Continuing Education Tuition Reimbursement Expenditures
for 1976, 1977, 1978

Dollars Spent	# of Companies 1976	1977	1978
None	5	4	4
100	1	2	3
200	1	1	1
300	2	1	
400	1	1	
500	1	2	1
600	1		
700			1
800			1
900			1
1,000	2	1	1
1,100	1	1	
1,300			1
1,400		1	
1,500		1	
1,700		1	
2,000	1	1	2
2,300			1
2,600	1		
4,000	1	1	1
5,500	1		
6,000		1	
6,600			1
9,100		1	
12,000	1		1
15,000		1	
20,000			1
61,300			1
Total Companies Responding	20	21	22
Median $ Spent	$400	$500	$800
Mean $ Spent	$1,580	$2,138	$5,268

APPENDIX D-2

Other Than Tuition Continuing Education
Expenditures 1976, 1977, 1978

Dollars Spent	# of Companies 1976	1977	1978
None	5	3	4
100	1	1	1
200	2	2	2
300		1	
400			1
500	2	1	1
600	1		
700		1	
800			1
1,000		1	1
1,200	1		
1,600	1		
1,800		1	
1,900		1	
2,000	3	3	3
2,100	1	1	1
2,200		1	
2,400			2
2,600	1		
3,600		1	
5,500			1
24,000	1		
30,000		1	
40,000			1
Total Companies Responding	19	19	19
Median $ Spent	$500	$850	$650
Mean $ Spent	$2,084	$2,663	$3,242

APPENDIX D-3

Total Estimated Continuing Education Expenditures for 1979, 1980, 1981

Dollars Allocated	# of Companies 1979	1980	1981
None	2	2	2
200	1	1	
300			1
400	1		
500		1	
600			1
800	1	1	
900	1		
1,000	1	2	2
1,100			1
1,500	1		
2,000	1	1	1
2,500	2	1	
2,800		1	
3,000			2
3,700	1		
4,000	1		
4,500		1	
5,000		1	1
6,000	2	1	1
6,500	1		
7,500		1	
8,000			1
8,500			1
15,000	1	1	1
20,000	1	1	1
70,000	1		
76,000		1	
82,000			1
Total Companies Responding	19	17	17
Median $ Allocated	$2,165	$2,250	$2,333
Mean $ Allocated	$7,526	$8,518	$9,206